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THE PLACE OF PHYSICS IN THE MODERN WORLD[1]

THE subject on which I am to speak is without doubt a very appropriate one for this occasion. It has the one drawback that I can not hope to say anything upon it that will be new to this audience. Under these circumstances I could wish myself to be a word artist, having powers to clothe familiar figures in a new imagery. As it is, I shall have to content myself with passing before you in parade some old facts, bare and unadorned.

We are living at a time when science has won for itself a prominent place on the stage of human interests. The great benefits conferred upon the world by scientific discovery are generally recognized. The applications of science touch our lives at every point and at every turn. It is not too much to say that science has not only transformed the manner in which we live but has changed also in good measure the very subject of our daily thoughts.

The last fifty years are without precedent in physics as regards the number of far-reaching discoveries which have been made and as regards the new insight gained into the processes of nature. These years are unequalled in the number and importance of the applications of science which have been perfected.

One not conversant with the situation might well ask, "Can this expansion go on indefinitely, and are we not now approaching the end?" The same question could have been asked with even greater force thirty years ago. No one can look far into the future. Our answer to the question must be read in the fact that never before in all time has science invaded the realms of the unknown at so great a pace as it is now doing. There are no limits in sight. So rapidly does advance follow on advance that new achievements are proclaimed daily by the press. A special science service has been organized to interpret the significance of new findings to the people. Moreover, industry has never before leaned so heavily on what science has to tell.

It is not my purpose to allot credit for what has been accomplished, among the different sciences, or as between science and its applications. The different

[1] An address given November 30, 1928, at the dedication of the new physics laboratory of the University of Minnesota.

branches of science all contribute greatly to our welfare. There is much interdependence among them and their fields overlap to such an extent that it is impossible to say where one science ends and another begins.

If I shall in my remarks attribute to physics what more rightly belongs elsewhere, or if I shall seem to imply that when all is said and done physics serves man most, you will understand, I feel certain, that this is an occasion when it is expected of me to extol the science whose newest temple we have come here to dedicate.

Modern life stands in marked contrast with the old largely because of what science and invention have evolved in the intervening years. These agencies have given us a new outlook on life. They have brought invaluable aids with which to carry on the work of the world. They have surrounded us with innumerable comforts and luxuries with which to enjoy our daily life. So accustomed are we to these advantages that we scarcely ever stop to think what it would mean to be without them.

It is a noteworthy characteristic of science that the discoveries of one generation are passed on to the next and thus become a permanent heritage of mankind. The things of most value are not all consequences of recent labors. Some though old and simple are nevertheless of paramount importance.

I may cite as an example the magnetic compass. Before its invention, the peril of the sea was a real peril. By this simple device, for these hundreds of years, myriads of vessels bearing people and commerce have been guided safely in their course and gone with full assurance where previously it would not have been prudent to venture.

As another example of a simple discovery of far-reaching effect I shall mention the invention of spectacles, which occurred some six hundred years ago. It would be difficult to estimate even the commercial value of this invention as measured by the increased efficiency of those millions who without glasses would not have been able to undertake many of the tasks they have done. Who, then, could evaluate the increased enjoyment of life that spectacles have brought to these same individuals, and more especially since the advent of the printing press?

I intend to dwell at some length on these commonplace practical values of science. These values mean so very much to the modern world that unless emphasis is placed upon them we shall get a distorted view of the place that science holds. It is by these values too that we must mainly justify the expenditures necessary for further scientific progress. Moreover, it is the industries that are calling for a constantly increasing number of scientific men. The universities, in laboratories like this, must be prepared to train for this purpose more men than they are now doing. These men must be taught the principles involved in the processes now in operation. They must be trained so that they can improve and extend these processes. In laboratories like this, under the guidance and by the example of experienced investigators, men must acquire the spirit of research.

There is to my mind no single invention that has made so great a contribution to our modern world as has the steam engine. With its coming man entered upon a new era. It introduced into the world of industry a great giant of almost unlimited power. This giant has relieved man of many of his most arduous labors. He does much that previously had been impossible of accomplishment.

As a direct consequence of this new power, the use of machinery has multiplied and multiplied up to its present stupendous scale.

The industries which use this machinery are deeply rooted in scientific soil. As new discoveries call for improvement in present methods or for new processes, industry seeks more and more aid from science. Manufacturers are constantly knocking at university gates for knowledge. More significant still is the fact that industrial organizations are finding it advantageous to maintain at great expense large research laboratories of their own.

Many successful processes even now used in manufacture are not fully understood. A given procedure is sometimes followed although it is not known what steps in it are essential and what ones not essential.

I know of an instance where hogsheads of water were regularly imported at great expense from Sheffield, England, for quenching purposes in hardening steel. It was thought by the workmen who came from that city that the secret of Sheffield's eminent position in cutlery is due to some special quality of its water.

The only safe thing to do in cases like these is to acquire more knowledge. The new spirit in industry, if I sense it aright, is that owing to the magnitude of its investments it must safeguard the future. It does this by constantly improving its methods on the advice of scientific men trained to understand its processes and needs.

It is by service like this that science has become the guide and mainstay of industry.

Equally important is the service that science does for industry in creating for it by basic discoveries great opportunities in new fields.

The steam engine made possible the railroad and the steamship. These in turn opened up markets which before could be reached only with difficulty, if at all.

The invention of the dynamo and the general utilization of the electric current have given birth to a great host of new industries. The electric light has dispelled gloom from street and building, and brought everywhere increased comfort and efficiency. The telephone, the telegraph and wireless knit community to community and country to country. Business is vitally affected by them. Our personal contacts are extended to wide limits. We are constantly seeing new marvels in the field of communication. Some of them would have been considered beyond man's reach less than a generation ago. We may now talk to a person hundreds of miles away and at the same time see his animated face. It is no exaggeration to state that, in effect, a dog baying at the moon may soon hear the echo of his reflected voice.

To my mind one of the most wholesome influences in our lives to-day comes from the opportunity we possess through electric communication of keeping in close touch with what is going on in the world. This intimacy increases our interest. It broadens our outlook. It deepens our sympathies. It helps us get away from the narrowing effect of single lines of endeavor. When great problems are agitating nations, we follow the course of events in their solution. In times of war, we live through the battles. When adventures are afoot, we join the expeditions—at our fireside. A short time ago we all flew thus over the north pole in an air-ship and looked down upon the masses of ice almost at the same time as did those aboard. More recently we lived for weeks with men lost on the polar ice. We listened to a recital of their plight and watched the heroic attempts at their rescue.

We are even now looking forward to the great adventure at the south pole. We shall follow the progress of events day by day and we shall thus feel a personal interest in the whole undertaking.

It is well within my memory that gasoline was looked upon as a dangerous substance. It had a habit on occasion of exploding with great violence. Its main use was as a cleansing agent. Then in 1885 along came a man to whom violence meant power. He learned how to tame the fluid, and the internal combustion engine was invented. The once shunned liquid is now sought so eagerly in every quarter of the globe that international peace is at times threatened.

The new engine was found adaptable to many new uses. With it, for example, the farmer pumps water, saws wood, tills the soil, harvests and threshes his grain. By its use the town and its markets are brought within his easy reach. The extent to which the automobile has come into use is nothing short of amazing. With it our nation seems to have gained a new freedom. It is a victory over space. A single invention has transformed markedly the habits of a people.

The internal combustion engine has also made possible human flight. Man has long dreamed that some day he might duplicate in a measure the unique performance of birds. Now in a few years, aided by most intensive scientific study, he has made such advances that he can fly much faster and much higher than any bird known. The airplane is assuming a place of responsibility in human affairs. Aside from the rapid transport of passengers and mail we are seeing it used, for example, in mapping a country, as a forest fire patrol, and as a rapid means of protecting crops against harmful insects.

A pressing need of the airplane for long flights is a less bulky fuel. Gasoline is not powerful enough. In recent years we have been hearing of how rockets were to be sent to the moon. We have heard of an automobile run by a rocket motor. We must not be surprised therefore if the future brings us motors run by materials more powerful than dynamite or T. N. T. Indeed there are men to-day searching for a means to bring material of a very high energy content, under control, for motor use. When this search succeeds, as it doubtless will, it may be possible to course around the world on a few pounds of fuel.

One of the far-reaching consequences of man's utilization of the various forms of mechanical power may be seen in what has thereby been brought within the reach of the average man. By the use of this power even a relatively poor man has the means to command the labor-equivalent of a large number of skilled hand workmen. Owing to this circumstance he can live in a better home; he can eat more wholesome food; he can give his children better advantages than ever before and still have some leisure for whatsoever his nature craves. The world may confidently look to science for the discovery of even greater powers by the use of which the effort necessary for healthful existence may be lessened still more.

What I have said serves to show that physics has played a leading part in the advancement of our prosperity.

It must be admitted that the men who brought to light the basic principles which made these great material gains possible did not have in view as a rule any utilitarian ends. The scientist delves but to learn the truth. He seeks to unravel the secrets of nature because the quest fascinates him. He is doubtless pleased to learn that the things he has discovered are of some use in the world.

It is interesting to note how often the unearthing of a single abstruse fact in one branch of physics proves to be of great service in other branches of the

same science and equally so in fields apparently not related. The discovery of X-rays is a case in point. This discovery stimulated work on electrical discharges in gases, from which the electron emerged as a common constituent of atoms. The X-rays inspired experiments that led to the discovery of radioactivity, which overthrew the old idea about the permanence of atoms and made us accept transmutation of elements as a fact.

To-day the physician uses the X-rays to explore the inner regions of our anatomy. He uses them to destroy unhealthy tissue and to stimulate the growth of new. The surgeon uses the rays to locate foreign objects in our bodies and to determine the nature of fractures in our bones. Calculate if you can the value of this last service to the millions injured in war and in the accidents of peace.

X-rays are used to locate flaws in metal castings. The plumber uses them to locate pipes in the partitions of our buildings. With them the customs officer looks for contraband in trunks. The rays are used to determine the ways in which the constituent parts of crystals arrange themselves. The regular sequence in the frequency of certain X-rays when they originate within different chemical elements disclosed the importance and meaning of atomic number, and told us how many elements remained undiscovered. I shall mention but one more thing in this connection and that is the very important discovery by Arthur Compton of a change of frequency suffered by these rays on reflection from electrons, work which gives us direct evidence of a change of momentum of a light quantum and has important bearing on the corpuscular aspect of radiation.

I can only allude in passing to the important influence that physics has had and is having on the other sciences.

The subject-matter with which physics deals is of such a basic character that it necessarily follows that new discoveries in our science find immediate application in the other sciences. Even our hypotheses and speculations are not without interest to them. The instruments and apparatus they use come from the physical laboratory or are special adaptations of such apparatus. The compound microscope, for example, finds important use in every science. One may safely say that whole fields of biology and medicine are built around its revelations.

Physics has a large problem in seeking to understand the universe. Experience has taught that most if not all of our so-called physical laws have only a limited range of validity. Physics must therefore have a broad vision, penetrating on the one hand to infinitesimal magnitudes and on the other stretching its imagination to the infinite.

We have in recent years been much concerned about radiation. This interest made it imperative that we know something more about the atom where the radiation originates. We finally arrived at a picture in which each atom is thought to be a miniature universe having parts separated by distances which compared to their size resemble the proportions between the sizes and distances involved in our own solar system. Among these new worlds the physicist wanders in spirit and seeks to learn what relations govern their actions. He strives especially to find where the atom keeps hidden those quantum packages of energy that are so characteristic a part of it. Why are these quanta of energy so closely associated with frequency? What does it all mean? There lies the mystery.

In an ancient city of India stands what is often called the most splendidly poetic building of the world. It is the far-famed Taj Mahal, which was built by the emperor Shah Jahan as a final resting-place for his favorite wife, Mumtaz Mahal. One of the princes of India some years ago told me the following story regarding it. When the mausoleum was being built the architect was authorized to embody in the structure some memorial to himself. He kept his own counsel and when the edifice was completed it was found that his memorial consisted in this—that whenever it rains from high up in one of the domes three drops of water fall in succession to the floor below. No matter how hard it rains or for how long, three drops and only three descend to bear testimony of the architect's wisdom. For nearly three hundred years men have puzzled in vain to learn by what artifice this result was accomplished, and the secret still lies hidden within the marble masonry of that dome.

In a like manner the Great Architect has so built the atoms of which the universe is composed that under excitation, regardless of its magnitude, radiant energy is given out in definite quanta. Men have labored for years to learn the secret of the process but it still rests hidden within the atom. It is more than likely that a search of three hundred years will solve the mystery. A solution will, however, only open up new problems still more mysterious. The search is endless. The ultimate is ever beyond our grasp. The scientist works toward a final goal that he well knows can never be reached, but this only makes the search more enticing.

As a boy I used to roam through the then primeval forests of this state. The farther I penetrated the more wonderful it all seemed. Had I ever come out on the other side I should have felt a keen disappointment and loss. Most of the fascination would have disappeared.

The best laboratory does not always satisfy the needs of the physicist. He wishes to know how things behave under greater pressures and at higher temperatures than those under his command. He goes to seek these conditions in the heavens. The aid of the astronomer is sought, since he is also looking for the very things we want to know.

Let us enter a great observatory. We stand in a mighty presence. The mysteries of unmeasured space look down upon us. The greatest of telescopes, soon to be surpassed, has a light-gathering power nearly a half million times that of our eye. Aided by the cumulative action of the photographic plate it reveals for study in our own galaxy some forty billion burning suns. In these suns are in progress physical experiments on a scale incomparably more vast than we can here hope to imitate. The record of their progress is being rushed into the object-glass of the telescope at the greatest speed the law allows, inscribed indelibly on a discredited ether. We stop to read the latest message from a certain nebula, and behold, our news is nearly a million years old, so long has our fleet and tireless messenger been on his way. How can our finite minds comprehend these immense stretches of space? Does space go on forever or does it have a definite but colossal limit? What are we, in all of this gigantic vastness?

But one by one, the stars are giving up their secrets. We know much about their distances, their motions, their composition, their relative ages, their masses and sizes and densities. One as large as the whole orbit of Mars is as tenuous as a high vacuum. One, though gaseous, is more than two thousand times as dense as our most dense earthly substance—platinum. Astonished we may be, but we must not quarrel with facts. Some of the stars have surface temperatures of nearly 20,000° C., and computed internal temperatures of 40,000,000° C. This internal heat energy creeps to the surface whence as radiant energy it passes out into space. What is the source of this energy? That is an old problem concerning which there has been much speculation. Various answers have been proposed in the past. A new conception is now taking root that energy is so intimately related to mass that it is possible for one to be transformed into the other. It is supposed that under the extraordinary conditions of temperature and pressure in the interior of a star we are having such a direct transformation of mass into heat energy. Accordingly, the stars and our sun as well are losing their own substance in this process of radiation. The fact has been expressed by saying that our sun loses four million tons of heat every second. Even at this enormous rate of loss, so great is the mass of the sun that in the last billion years it would have radiated away only 0.01 per cent. of itself. Such ideas as this strike deep at the meaning of our fundamental physical concepts. For a long time matter was supreme and indestructible. It was supposed to be made of impenetrable atoms. The space between them became permeated with caloric and with the light-bearing ether and with electric fluids. The caloric vanished into molecular motion, the ether got to be regarded as an unnecessary luxury, and the electric fluids condensed themselves into units of electricity, attached like leeches to the material atom. Not long since, the parasitic atoms of electricity consumed completely their material hosts, bringing the advent of the electrical theory of matter. According to this, all material is made up simply of the two kinds of electricity, the positive proton and the negative electron. Are these then the ultimate entities? No. We must go at least one step farther. Recent experiments on the scattering of electrons by matter have shown that electrons have associated with them systems of waves. These waves are now on the way to sinking the old electron out of sight. Some scientists are led to think of electrons, now, as mere singularities in space, places where wave systems of infinite extent meet in the same phase. Others there are who would not leave us the comfort even of this indefinite picture of an electron. They seem to fear that if we draw any picture at all we are almost certain of putting something into it that does not belong there, and which later will hamper us in our race after the truth.

And finally we are to contemplate the spectacle of the proton and electron dissolving into each other and reappearing in the form of radiant energy. What was their former substance is scattered to the ends of space. Since we have become accustomed to the wave aspect of electrons, this action need not surprise us greatly.

And now that our glorious universe is slowly wasting away, we may again ask what is this radiant energy that is to be the end of all. We know that it is related to a frequency through a certain universal constant, designated as h. That is all we know, and that isn't much. Still, it is a beginning.

But must we lose our universe forever once it is gone? Is there no way to bring it back or still better to prevent its going? Millikan and Cameron by a recent pronouncement are showing a way out of our difficulty. They conclude that cosmic rays which they have been studying must originate in the cold regions of interstellar space. The rays are of such frequencies that they may consistently be supposed to arise from a union of electrons and protons into atoms of our well-known chemical elements. And how do the electrons and protons get out there into space? It is

supposed that they themselves are formed in the same region, somehow, by a condensation of radiant energy.

In these cold regions, then, our material universe is thought to be rebuilding itself. Unfortunately, the complete process involves the absorption of heat at a cold source and its evolution in a hot region. We should have to disregard for this region, then, the second law of thermodynamics which has always held before us the sad specter of a universe in its final state, cold and dead.

Let us be frank and admit that in some of these speculations we are as yet skating on very thin ice.

The leaning tower of Pisa has long been looked upon as a shrine for the physicist. Here Galileo started a new science by finding that different objects dropped from the top all reached the ground in the same time. Recently Italian engineers have discovered that the foundations of the famous building are watersoaked and weakened. Concrete is being injected into them to ensure the tower's safety.

The science of physics has been building a wonderful structure. With the passage of time we have added a wing here and a tower there. As we viewed the edifice from the outside we have admired its noble conception and its grand proportions. As we walked through its halls and chambers we rejoiced at the richness and splendor of their appointments.

In recent years, however, some of our suspicious members began to dig around the foundations and discovered that the whole structure was built on sand. The breadth of the building is all that has kept it from showing a tilt long ago. The engineers have been getting their heads together to see what should be done. Much concrete has been injected into the sand, and yet all is not well. The fundamental concepts of space and time and mass and energy have been carefully scrutinized. Under the pressure of this process, space first became somewhat warped. Now it has started to turn into a mathematical matrix. Time has lost some of its individuality, and mass and energy, as already stated, are thought to be related and mutually transmutable. The air is filled with speculations. We have even begun to wonder whether our finite minds are equal to the task of a full understanding.

The philosophers have become actively interested in our foundation problem because they live next door on the same lot, and so our problem is also their problem. Not long ago the physicist was inclined to think that there is not much in common between physics and philosophy. Many felt that one was dealing with real things whereas the other was quibbling over imagined niceties. Now those imagined niceties have loomed into importance, and we realize that involved in them somewhere may be elements necessary for further advance. Here the two fields have come to overlap. The philosopher now talks about relativity, and the physicist ponders over the relation of sense impressions and objective reality.

Some years ago during the heat of a discussion with one of my former colleagues, having exhausted what arguments I had in defense of a stand I had taken, I was driven to say that somehow I felt the truth of my position from the very depth of my bones. Ever since that day these poor old bones of mine have been carted from one end of this country to the other and exhibited unnamed for public ridicule. Well, I again need the support of those same bones and so I have brought them with me.

The simple argument I wish to give is this. We all realize the fact that our knowledge of things external to us comes to us through our senses. I am ready to admit that the interpretation of our sense perceptions is often faulty. It may be that only as a most plausible hypothesis can we assume there is really anything external to us which corresponds to our sense impressions. But when exact proof is lacking one may still have a conviction. So somehow deep in my bones I feel that there is a real world corresponding to our sense perceptions. I feel that out beyond my touch there is a real audience. I believe that Minneapolis is a real city and not simply a city of my dreams.

It is not surprising that the applications of science, spectacular as some of them are, should excite popular interest. It is more significant that this interest extends to discoveries having at present academic value only. We do not wonder that X-rays created a great stir when discovered, because their application to surgery was immediate. It is remarkable, however, that the theory of relativity should have caught the public fancy, and that to-day it becomes of interest as international news to announce that a renowned scientist is on the verge of a great discovery in theoretical physics.

The world is looking for new visions to serve as guiding stars, and physics is constantly supplying these new visions. Visions stir men to great effort and they lead the mind to a contemplation of eternal truths. In this sense physics is a great spiritual force. Looking at the universe from its minutest detail to its infinite magnitudes we see amid the great complexity an order whose source we can not fathom. The knowledge that this law and order has served as a safe guide for science has had a steadying influence on mankind. Superstition has been dissipated. There is in the world a profound respect for physical laws. This respect has matured because the consequences of physical action are so sure and prompt and definite. In contrast, people constantly think they can evade

the laws of biology. They do not have full faith in them because the consequences of these laws follow less promptly and less definitely.

There are some who believe that the great material advancement made possible by science has resulted in less attention being paid to the higher things of life.

Some new evils have come, but these always accompany radical changes in the habits of people. We must learn how best to counteract them. So much has been added to the world in a short time that it is difficult for us as yet to put each thing into its proper place. We shall have to learn to accommodate ourselves more quickly to new conditions. If necessary, we must, by education and organization, see to it that old activities of lasting value are not crowded out of our leisure hours by mere useless pleasures. The ways of the world have changed, but in the great essentials of life we have gone forward and not back. The millennium has by no means arrived. I believe, however, that there is now less selfishness and more love of man for man than ever before. Charity, though organized, is no less real, and more effective. Men have never given so freely for purposes designed for the common good. When tested by the measure of service placed before self, the world dominated by science is not found wanting.

Dissatisfaction often arises because methods of getting things done have changed rather than from lack of accomplishment. The churches have learned to extend their influence by broadcasting their services by radio. They realize that if a human soul is moved to repentance by words entering the home from space, the result is fully as valuable as it would have been were the message received amid the beautiful surroundings of a consecrated temple. Let those who decry the present, instead of railing at it, adopt its methods and use them for whatever noble ends they have in view.

The tide of scientific progress sweeps relentlessly on. It will engulf any who oppose its flow. The old world is gone, never to return. So long as men exist there will be those among them who will sacrifice all to search for truth, and there will be others who will apply new truths to their own ends and to the benefit of mankind.

JOHN ZELENY

YALE UNIVERSITY

BASHFORD DEAN

1867–1928

BASHFORD DEAN, former curator of the department of arms and armor at the Metropolitan Museum of Art, New York City, honorary curator of the department of ichthyology, American Museum of Natural History, and late professor of zoology, Columbia University, died on December 6, 1928, at Battle Creek, Michigan, aged sixty-one years.

Bashford Dean was born in New York City, October 28, 1867. His families on both sides were "Old Americans." The Deans were of English and "Holland Dutch" derivation and had lived in the region of Tarrytown since before the Revolution, his paternal great-grandfather, John Dean, having been a captain in the American Revolutionary army. His mother's family was of English and "French Huguenot" stock, of Yonkers and New Rochelle.

His sister, Miss Harriet Martine Dean, states that his interest in armor appears to have originated when he was about five or six years old, when he saw a beautiful helmet in the residence of Carlton Gates, of Yonkers. This object fascinated him and he asked and received permission to examine it closely. It seemed to make a deep impression on him. Later, when he was about ten or eleven years old, the owner of the helmet died, and he attended the executor's sale of the household effects and attempted to purchase the helmet, which to his deep disappointment was sold to some one else. He purchased, however, two very beautifully engraved daggers with scabbards, which he always treasured. In later years he made numerous unsuccessful attempts to trace and locate the helmet, which he felt was a very valuable one and to which he attributed his first interest in the subject.

His interest in fishes began when he was about seven years old, through the influence of an old friend of his father's, Professor Edward S. Morse, of Salem, Mass. At this time he made a drawing of a fish, showing the heart and blood vessels.

He attended the College of the City of New York, where he came under the influence of Dr. John Draper and of Professor William Stratford, a noted teacher of zoology, being graduated in 1886 at the age of nineteen. He then entered Columbia College, where he studied geology and fossil fishes with Professor John Strong Newberry, whose labors on the Devonian fishes of New York and Ohio he was destined to carry on in later years. In 1890, at the age of twenty-three, he received the degree of Ph.D. from Columbia University, his dissertation being entitled "Pineal Fontanelle of Placoderm and Catfish," the title indicating the thorough fusion of zoological and paleontological concepts which characterized all his work.

He began his teaching career in zoology immediately after his graduation in 1886, when he was appointed tutor in natural history at the College of the City of New York. At the same time he became an assistant in the New York State Fish Commission, for which

he prepared his first scientific paper, a report on the supposed fish-eating plant, *Utricularia*. Beginning in 1889 he made special investigations for the United States Fish Commission of oyster culture in England, France, Belgium, Spain, Portugal, Italy and later in Japan. Thus was laid the foundation for his remarkably detailed knowledge of the languages, customs and countries of western Europe and of Japan, which was so useful to him both as a zoologist and as a persistent student of ancient arms and armor. At the same time he was a keen observer of the many biological stations at which he studied, and he wrote several papers on this subject. As early as 1890, when only twenty-three years old, he was appointed director of the Biological Laboratory at Cold Spring Harbor.

In 1893 he married Miss Alice Dyckman, of the old Dyckman family of the northern end of Manhattan Island. She has ever been his steadfast and helpful consort in sickness and in health. His health was always more or less precarious on account of a delicate digestive system. In spite of this handicap, or possibly in part because of it, his will power, energy and output always amazed those who knew him best and bore him up in his immense labors and almost ceaseless travels.

His success in all things was brilliant. As an artist his drawings of developing eggs and of ganoid and hagfish embryos had all the minute perfection and finish of the best Japanese work. His blackboard diagrams, drawn with amazing speed and often with both hands, never failed to arouse the enthusiasm of his devoted students at Columbia University, during the many years of his active teaching there. His own lithographic engravings adorned certain of his memoirs, while his line drawings contributed much to the value of his admirable and now classic text-book on "Fishes, Living and Fossil" (1895).

As a student of the old Devonian fishes he edited Newberry's memoirs and published a long and brilliant series of his own. His studies on the Devonian sharks and on a development of the more archaic recent sharks produced important evidence in favor of the view that the pectoral and pelvic fins had arisen as fin-folds, like the median fins, as maintained by Thacher and others; this was in opposition to the famous theory of Gegenbaur, that the most primitive paired fins were the feather-like fins of the Dipnoan fishes, and that these in turn had arisen from cartilaginous rays attached to the outer sides of the gill arches. Professor Dean always opposed the view of Eastman and others that the Arthrodires were related to the Dipnoans, and much critical evidence recently brought to light by Stensiö abundantly supports Dean's position.

Before he became almost completely immersed in the study of armor, Professor Dean had published an important series of papers and memoirs on the embryology of the sturgeon, the garpike, the bowfin, the California hagfish, and the chimæroids, or silver sharks; but perhaps the greater part of his material, including a large series of beautiful plates dealing with the early development of the Port Jackson shark remains to be worked up and published, it may be hoped, in his memory.

The breadth and many-sidedness of Dean's zoological work is well shown in his Carnegie Institution memoir on "Chimæroid Fishes and their Development" (1906), in which he was able to settle for all time the status of these curious forms as highly specialized sharks rather than as intermediates between sharks and higher fishes.

As curator of the Department of Fishes (1903-1910) in the American Museum of Natural History, Professor Dean, with his assistant, Dr. Louis Hussakof, planned and directed the installation of a series of mounted habitat groups, illustrating the life and habits of the ganoid fishes, namely, the spoonbill, the sturgeon, the garpike and the bowfin; also the group showing the spawning of the brook lamprey and many others. During this period also he and his staff installed the synoptic exhibit of fishes and the "fossil aquarium," containing life-like restorations of many of the fossil fishes of the Old Red Sandstone of Scotland.

In 1910, owing to the pressure of other duties, Professor Dean resigned as curator of the department of ichthyology and was appointed by the grateful president and trustees of the museum as honorary curator of the department. It was in this period of his honorary curatorship that with the cooperation of his colleagues and assistants he was enabled to bring to a successful issue one of the greatest enterprises of his life, namely, the "Bibliography of Fishes." This work began very early in his professional career (1890) in the form of an index to references to zoological papers on fishes, and by 1900 it included about twenty thousand cards. Through all the years of his extensive travels in Europe, of his duties in so many directions, he and his coworkers kept adding to this index until it grew to colossal proportions. In 1910, he tells us " . . . my index reached a critical stage in its development. It had become an unwieldy enterprise—too large to be carried on single-handed, yet too valuable to be abandoned. Then it was, at the instance of President Henry Fairfield Osborn, that the American Museum of Natural History happily came to my aid; it allowed me the help of a secretary for transcribing references and since then it has with

great generosity provided the means for editing and enlarging the work."[1]

Nor did he forget to record "certain private subscriptions," notably those of Mrs. Isaac Michael Dyckman and Mrs. Bashford Dean; these and other members of his family were always most willing to help forward any of his scientific or educational enterprises. The first volume of the bibliography, as enlarged and edited by Charles Rochester Eastman, was published by the museum in 1916; the second volume in 1917; the third and most difficult volume, including the great subject index, as extended and edited by Eugene Willis Gudger with the cooperation of Arthur Wilbur Henn, appeared in 1923. It is impossible to overestimate the usefulness of this system of keys to the vast treasury of knowledge of fishes. Fortunately, although Dean himself has passed on, the work on his bibliography is being continued and it is the intention of the museum to publish within a few years still another volume, covering the period since 1914, the closing date of the previous volumes.

Professor Dean's life-long pursuit of the subject of arms and armor will no doubt be treated in a special article by one of his colleagues in the Metropolitan Museum of Art, but the subject formed such an integral part of the man that it can hardly be neglected in this brief survey of his life. The parallel interests of zoology and armor often intertwined themselves in his career. At times the pursuit of the one aided the cultivation of the other, as when his search for the early stages of development of certain fishes of Japan gave him an opportunity to collect a remarkable series of Japanese arms and armor, or when his early studies on oyster culture in France, Belgium, Spain and Italy gave him the opportunity to visit some of the old castles where armor was still to be seen in its native setting. As a keen student of the evolution of the armored fishes of Devonian times, he was quick to perceive the striking analogies in the evolution of human armor. In short, the study of armor was to him almost a branch of zoology. His first interest was always the determination of the chronological horizon and the country of origin of the individual piece. And to afford adequate comparative data for this subject he amassed thousands of sketches and notes, all classified and arranged after the fashion of the fish bibliography. Indeed a great bibliography of arms and armor, the crowning work of himself and his colleagues, is even now ready for publication. And just as he planned the habitat groups for the display of the old armored fishes in the Museum of Natural History, so did he plan and install the brilliant exhibition of armor in the Museum of Art.

[1] "A Bibliography of Fishes," 1916, Vol. I, p. viii.

After this country entered the World War, he was appointed major in the Ordnance Department. He studied field conditions of trench warfare in Europe and was engaged in designing improved helmets and other special armor, when the sudden ending of the war set him free to resume his toilsome journeys in pursuit of collections of armor. Thus by his unceasing efforts the Metropolitan Museum collection finally rose to high rank (perhaps fourth) among the great collections of the world.

Nor should we forget to record Dr. Dean's service in reconstructing the Dyckman House and Park near the northern end of Manhattan Island. This was presented to the City of New York in 1916 by Mrs. Bashford Dean and her sister, Mrs. Alexander McMillan Welch, in memory of their parents, Mr. and Mrs. Isaac M. Dyckman, who were descendants of a family that had lived on or near this property for about two and a half centuries. Dr. Dean and Mr. Welch rescued the house from dilapidation and restored each room with appropriate furniture and memorabilia of its former owners.

At the time of his death he was actively interested in the plans for the development of the new Museum of the City of New York, which is designed to show the life of the inhabitants of Manhattan Island and vicinity from the earliest time to the present day.

In recognition of his multifarious services to science, education and art, honors came to him from many sources. Thus the former Emperor of Japan on two different occasions bestowed upon him an inscribed silver saké bowl, in token of his gratitude for Dr. Dean's services to Japanese ichthyology and armorial history. In 1910 he was made a Chevalier de la Légion d'Honneur. He was an active member of many American scientific and historical societies and corresponding or honorary member of the London and Mexican zoological societies, of the Moscow Society of Naturalists and of the Paris Museum of Natural History. In 1923 he received the D. G. Elliot medal from the National Academy of Sciences in recognition of the great value of the "Bibliography of Fishes" to students not only of ichthyology but also of many branches of the biological and cultural sciences.

On the next to the last night of Dr. Dean's life many of his friends and colleagues, none knowing of his serious illness, attended a reception given in honor of himself and Mrs. Dean in the new Hall of Fishes in the Museum of Natural History. This hall he had years ago planned in outline, and for the last three years his devoted colleagues and successors have rejoiced to develop it in the spirit which he inspired in them.

In 1927, heeding at last the signs of waning endurance, Dr. Dean resigned from the curatorship of armor and was made a trustee of the Metropolitan Museum. But his ever creative spirit continued to renew itself. He designed, built and with his own hands decorated a high and noble Gothic hall connected with his residence at Riverdale, N. Y. In this he had begun to install his private collection of armor when the cord of life was snapped. The visitor who stands within this silent hall will be enabled to feel with him the somber but potent magic of old armor, that for so many years had sent him wandering over the earth.

In conclusion we may safely affirm that Bashford Dean was always visualizing ideals in science and in art, but that he was never content merely to enjoy them himself, but labored with consecrated zeal to build them with imperishable art for the benefit of his friends. And his friends were all those with whom he came in contact.

WILLIAM K. GREGORY
AMERICAN MUSEUM OF NATURAL HISTORY

SCIENTIFIC EVENTS

YELLOW FEVER IN AFRICA

DR. AUGUSTE PETTIT, professor at the Institut Pasteur de Paris, who with Dr. Stephanopoulos was sent to Senegal, French West Africa, last winter to study the epidemic of yellow fever, has recently communicated his observations to the Academy of Medicine. The first part of his report, as summarized in the *Journal* of the American Medical Association, is devoted to the memory of the eminent scientists who succumbed there to the disease: Stokes, Young and Noguchi. The death of Noguchi is all the more regrettable because of the fact that the researches that he undertook have been abandoned, while all the monkeys inoculated by him have been allowed to die. They were valued at half a million francs. Furthermore, the government of French West Africa has issued an order prohibiting the inoculation of the monkeys of the colony for fear that they may become adapted to the virus, and that, on escaping, which is a frequent event, they may serve to spread the infection. Dr. Pettit made use of a species of monkey of the genus *Macacus*, brought from India, and carried on his researches at the Institut Pasteur, using a virus from Senegal that was furnished him by Professor Sellards, of Harvard University. His first conclusion is that the agent of yellow fever is not a spirochete, as Noguchi believed, but an invisible filtrable virus. That was the opinion advanced also by the Marchoux mission in 1903. This virus can be inoculated into monkeys, and the sick monkeys are cured by injecting into them the serum of a human being who has recovered from yellow fever. Dr. Pettit succeeded in preparing an attenuated virus that serves as an effective vaccine for the protection of monkeys. He has prepared 600 vials of this serum, which is a genuine protective and curative agent. It remains to be discovered whether the serum of these vaccinated monkeys will serve, in turn, as a vaccine for man. That is the problem with which Dr. Pettit is engaged at present, and in view of the results already secured, he feels that it is probable. His researches have been hindered through lack of monkeys, owing to an advance in price since they have been used in Europe for testicular grafts, and the funds at the disposal of the mission are now inadequate.

THE BRITISH INSTITUTE OF RADIOLOGY

THE British Institute of Radiology opened its 1928-1929 session with an exhibition of apparatus and a presidential address at the Central Hall, Westminster, on November 17.

The London *Times* reports that the exhibition, which is expected to become an annual event, illustrates the rapid strides being made every year in the manufacture of equipment, improvements following each other with such rapidity as to render many forms of X-ray appliances obsolete within a very short period. The bulk of the exhibits are British, and the most notable feature of their latest improvements is the protection now afforded to the X-ray operator, whose risk of injury, it is claimed, has been much reduced. Another device, by using more power with the tube at a greater distance from the film, enables a more accurate shadow picture to be taken. Of new ideas for enabling the doctor to handle a patient with greater facility there are many, including a combined operating and X-ray table, which has recently been introduced into one or two special hospitals.

Dr. G. W. C. Kaye, in his presidential address, said the amalgamation of the institute and the Röntgen Society two years ago had left some minor difficulties to be surmounted, but with patience, good-will and tolerance the institute would presently find itself able to speak with an undivided voice on all things affecting its work and objects. To commemorate the work of its two great founders, Archibald Reid and Robert Knox, the council had named the lecture hall of the institute the Reid-Knox Hall. The membership, now 800, was steadily growing, and he hoped it would reach 1,000 before his term of office closed. The institute's examination attracted an ever-increasing number of candidates, and the "M. S. R." was steadily becoming recognized as the hall-mark of the competent radiographer.

After a historical survey, Dr. Kaye turned to recent developments. He said the discovery that X-rays could be totally reflected at fine glancing angles made it possible to use ruled reflection gratings for the production of X-ray spectra, and so gave a new and fundamental method of measuring X-ray wave-lengths. The method, had, moreover, proved invaluable for exploration of the region of wave-lengths occupying the former gap between the ultra-violet and the X-rays. Interest in those long-wave X-rays had also been evinced in medical circles both for treatment and diagnostic work. Low-voltage X-ray tubes with specially-transparent windows were now available. Incidentally, it would be a convenience to have a "handy" name for the "intermediate" rays. He had suggested that the term "W-rays" would complete the alphabetical sequence between "U V-rays" (ultra-violet rays) and X-rays.

At the other end of the scale, Coolidge's recent experiments with cathode ray tubes excited by nearly a million volts were obviously paving the way to X-rays corresponding to the same order of voltages. Several laboratories in the United States possessed million-volt generators, and there was one in Britain at the National Physical Laboratory which members would see at a demonstration. At Pittsfield the General Electric Company of America had attained to voltages of some five million.

The science of radiology was now of world-wide importance, concluded Dr. Kaye. The manufacturer of radiological equipment no longer occupied the position of instrument maker, but had become a fully-fledged electrical engineer.

THE BUREAU OF INDIAN AFFAIRS

TRANSFER to states of the activities of the Bureau of Indian Affairs dealing with education, medical attention and relief of Indians, a proposal made by the Department of the Interior, would be authorized under House Resolution 7031, which the House Committee on Indian Affairs has favorably reported to the House. According to the *U. S. Daily*, the committee says that the measure while not removing federal protection from the Indians would authorize federal and state cooperation.

The bill was introduced by Representative Leavitt (Rep.), of Great Falls, Montana, chairman of the committee, and is similar to H. R. 6075, introduced by Representative Kelly (Rep.) of Pittsburgh, Pa. The proposal has the approval of the Bureau of the Budget.

Its purposes are set out in a letter, made public by the committee, from the former Secretary of the Interior, Hubert Work, to Chairman Leavitt, dated January 13, 1928, as follows:

I have the honor to reply to your requests of December 14 for reports on H. R. 7031 and H. R. 6075, both of which cover proposed arrangements for the transfer to states of activities of the Indian Bureau dealing with education, medical attention and relief of Indians. Inasmuch as the bills are identical in purpose and substantially identical in language, it is felt that both may be covered in a single report.

The principle underlying the proposed legislation is in agreement with my belief that the time has arrived when states directly interested in the civilization and advancement of Indians should begin to assume a greater degree of responsibility for Indian affairs, especially in the matter of directing the activities specifically mentioned in the bills under consideration. In several specific statements, including reports on legislation having the same general objective, introduced during sessions of the Sixty-ninth Congress, and in recent annual reports to the president, I have expressed this view.

A number of states directly concerned have given indications of a disposition favorable to the proposal and there appears to be little reason to doubt that their attitude in the matter be regarded as indicative of a general willingness on the part of the state authorities to assume further responsibility in the administration of Indian affairs.

The proposed legislation has my approval and I recommend that it be enacted into law.

Under date of January 4, 1928, the Bureau of the Budget advised that this report is not in conflict with the financial program of the president.

In its report the committee states:

For a number of years those constructively interested in the welfare of the Indians have been growing in the belief that it should be made possible for such states having considerable Indian population as have developed efficient agencies to deal with health and educational problems and to relieve distress among the indigent to give the benefit of such agencies to their Indian population as well as to the white.

Already some states, notably Minnesota, are giving attention to the health of the Indians, not only for the sake of the Indians but for the protection of the people generally. Dr. Guthrie, the head of the Indian health work and a trained officer of the Bureau of Public Health, has testified to the great value of such cooperation. In many of the states the Federal government has been paying tuition for the education of Indian children in the public schools, this over a sufficient period of years to demonstrate its unquestioned value.

At its last session the Legislature of Wisconsin enacted a law authorizing the government to enter into contracts with the federal government for the education, health, relief of indigency and promotion of agriculture among Wisconsin Indians, thus leading the way for legislative enactments by such states as so desire to enable them to cooperate in like manner.

THE U. S. COAST AND GEODETIC SURVEY AND THE AMERICAN ENGINEERING COUNCIL

THE American Engineering Council has announced that it will actively oppose legislation in Congress to transfer the geodetic work of the United States Coast Guard and Geodetic Survey from the Department of Commerce to the Department of the Interior.

The council acted upon a report of its president, Arthur W. Berresford, who made an investigation of the situation, coming to the conclusion that there is little advantage and much potential disadvantage in the proposal. He states that:

> The Geodetic Survey is a division of the government activities, insignificant in numbers and cost (forty-five employees and $112,800 appropriation), but of major importance in performance and possibilities.
>
> Its ambition is the ultimate of exactness in its field, and therein its members may fairly be classed with those scientists who, in the fields of chemistry, electricity, light and other divisions of physical research, are striving to add to the world's store of exact knowledge. Really precise work can be done only by men whose ambition it is, and who glory in the accomplishment achieved at the expense of painstaking in a degree which, to the average man, would be utter drudgery and a thing to be shirked.
>
> The Geodetic Survey is made up of such men. They are located where the necessity for such work as they do is understood and where it is of major importance, and where continuous and adequate recognition is given.
>
> It is no criticism of the Geological Survey to say that these are not its standards. They should not be. Their work, from the surveyor's viewpoint, calls for no such accuracy.

It is the opinion of Mr. Berresford that while the work of both is based upon surveying, there is no actual relation between the work of the Geological and Geodetic Surveys. The work of both surveys can be coordinated when necessary, but the fact that both are land surveys is no reason for combining them. The work of the Geodetic Survey is only about 60 per cent. completed and the present force must be retained.

SCIENTIFIC NOTES AND NEWS

JOHN MERLE COULTER, professor of botany in the University of Chicago, died on December 24 in his seventy-eighth year. Since his retirement, Dr. Coulter has been botanical adviser to the Boyce Thompson Institute at Yonkers, N. Y.

HENRY B. FINE, professor of mathematics and dean of the departments of science at Princeton University, died on December 21, at the age of seventy years. Professor Fine suffered injuries from an automobile while riding a bicycle.

DR. IRVING LANGMUIR, assistant director of the General Electric Research Laboratory at Schenectady, has been elected president of the American Chemical Society.

DR. MAX PLANCK, professor of physics at the University of Berlin, has celebrated his seventieth birthday. To commemorate this occasion his friends and colleagues have founded a gold medal to be awarded for distinguished work in theoretical physics.

DR. E. D. ADRIAN, lecturer on physiology at Cambridge, has been appointed one of the Foulerton professors of the Royal Society in succession to the late Professor Starling.

THE Pennsylvania Society of New York has conferred its gold medal on Dr. William W. Keen, of Philadelphia.

PROFESSOR ARTHUR H. COMPTON, of the University of Chicago, has been awarded the gold medal of the Radiological Society of North America for his studies of the nature of X-rays, the work which won him the Nobel prize.

THE Perkin Medal meeting of the Society of Chemical Industry, the American Chemical Society, the Société de Chimie Industrielle and the American Electrochemical Society will be held on January 4, when the medal will be presented to Mr. Eugene C. Sullivan. An informal dinner, at 7 P. M., will precede the meeting, after which the following program will be presented in Rumford Hall of the Chemists' Club at 8:15 P. M. "Early Days of the Medallist," Alfred H. White; "Accomplishments of the Medallist," Dr. Arthur L. Day; Presentation of Perkin Medal, Dr. William H. Nichols; Acceptance speech, Eugene C. Sullivan.

AT the annual meeting of the New York Academy of Sciences the A. Cressy Morrison prize of $500 was awarded to B. P. Gerasimovic, of the Harvard College Observatory, and Donald H. Menzel, of the Lick Observatory, for a thesis on "Subatomic Energy and Stellar Radiation." A second prize of $250 was awarded to Herbert Ruckes for a paper on "Truss and Arch Analogies in Chelonian Osteology."

THE honorary degree of doctor of science was conferred on Dr. James W. McBain, professor of chemistry in Stanford University, by the University of Bristol this summer when he was in England. Professor McBain had been on the faculty of that university for twenty years, during the last seven of

which he held the Leverhulme chair of physical chemistry.

BELOIT COLLEGE conferred the degree of doctor of science on Roy Chapman Andrews, who graduated from the college in the class of 1906, on the occasion of the convocation exercises on December 18 in recognition of his explorations in Asia.

THE New Zealand Institute has awarded its Hector medal and prize for 1928 to Professor D. M. Y. Sommerville, of Victoria University College, Wellington, for his mathematical work as a whole and for his investigations in non-euclidean geometry.

THE title of doctor of natural history has been conferred on Boris III, King of Bulgaria, by the University of Sofia, in recognition of his work on the fauna and flora of the country. The king's palace is said to house one of the finest museums in the Balkan states.

LORD RAYLEIGH has been appointed a trustee of the Beit Memorial Fellowships for Medical Research in succession to the late Lord Haldane, who died on August 19 last.

SIR FREDERIC STUPART, director of the Meteorological Service of Canada, whose headquarters are in Toronto, will retire on January 1 after forty years' service.

DR. L. L. VAN SLYKE, who recently retired from his position as chief in research in the division of chemistry of the New York Agricultural Experiment Station at Geneva, New York, will spend the coming year in Honolulu.

DR. GREGORY BREIT, mathematical physicist of the department of terrestrial magnetism of the Carnegie Institution, has been assigned to carry out work for a year in atomic physics in various laboratories and universities of Europe.

BECAUSE of the pressure of his present executive duties, Dean Theodore J. Bradley, of the Massachusetts College of Pharmacy, is compelled to relinquish the chairmanship of the Pharmaceutical Syllabus Committee, after many years of service in the position. Professor John G. Beard, of the University of North Carolina, has been unanimously elected as the new chairman of the committee and immediate steps will be taken to proceed with the preparation of a fourth edition of the syllabus.

DR. LOUISE STANLEY, chief of the Bureau of Home Economics of the U. S. Department of Agriculture, known for her scientific investigations in nutrition, has been appointed an official representative of the Department of Agriculture on the American Standards Association.

LEON B. REYNOLDS, professor of hydraulics and sanitary engineering at Stanford University, was elected president of the California Sewage Works Association, at a recent joint meeting of the association and the League of California Municipalities. Professor Reynolds was a delegate to the latter from the city of Palo Alto.

AT the recent anniversary meeting of the Royal Society Sir Ernest Rutherford delivered the presidential address, discussing the present state of experimental knowledge in regard to the possibilities of producing very high-frequency radiation of the X-ray type.

DR. HERMANN JOSEPH MULLER, of the department of zoology, of the University of Texas, lectured before the Franklin Institute, Philadelphia, on December 19, on "The Enigma of the Gene and of its Mutation."

DR. CHARLES H. HERTY addressed the West Virginia Alpha Chapter of Phi Beta Kappa, West Virginia University, on December 5.

DR. E. M. CHAMOT, professor of chemical microscopy at Cornell University, recently lectured before the Northeastern section of the American Chemical Society on "The Advantages of Microscopy to the Chemist."

PROFESSOR HARLAN TRUE STETSON, of the astronomical laboratory of Harvard University, gave an illustrated lecture on "Sunspots and Correlated Phenomena" before the Brown Chapter of the Society of Sigma Xi on the evening of December 19. The lecture was given at the physical laboratory in Wilson Hall, Brown University, and was open to the public.

PROFESSOR F. D'HERELLE, of Yale University School of Medicine, gave a Mayo Foundation lecture at Rochester on November 15, on "The Phenomenon of Recovery."

FRANZ X. SHAFFER, director of the Museum of Natural History of Vienna, will lecture at the summer session of the University of California in 1929. His subjects are geology and paleontology.

DR. ALBERT BRACHET, of the University of Brussels, visiting professor for the Commission for Relief in Belgium Educational Foundation, known for his work on heredity and embryology, delivered a series of three lectures at the University of California on December 17, 18 and 19.

THE University of Chicago has announced that Dr. Heinrich Poll, professor of anatomy at the University of Hamburg, Germany, lectured at the Albert Merritt Billings Hospital, December 20, at 4:30 P. M.,

on "Adrenalin, Insulin and Sex Hormones from the Viewpoint of their Interrelationship."

FRANK SARGENT HOFFMAN, Archibald Spencer professor emeritus of philosophy at Union College, where for thirty-three years he was a professor, died on December 21, at the age of seventy-six years.

SIR HECTOR CLARE CAMERON, emeritus professor of clinical surgery in the University of Glasgow, died on November 22, aged eighty-six years.

THE annual general meeting of the American Philosophical Society will be held on April 18, 19 and 20, 1929, beginning at 2 P. M., on Thursday, April 18.

AT the recent meeting in New York City of the Middle Atlantic Fisheries Association, W. F. Morgan, Jr., was reelected president and Sol Broome was reelected secretary. Frank B. Coates was elected vice-president and Jerome L. Stewart, treasurer. The convention was concluded with a dinner at which Commissioner O'Malley and Deputy-Commissioner Lewis Radcliffe were guests of honor.

Nature reports that delegates from forty nations recently attended in Paris an International Conference for the Limitation of Exhibitions, when a convention was signed agreeing to limit the number of general long-period exhibitions which are officially recognized to once in ten years at the least in the same country and once in two years at least in all countries. Special exhibitions confined to one trade or industry are limited less strictly. The convention does not apply to any exhibitions which do not seek official recognition or to sample fairs such as that of Lyons or the British Industries Fair. Great Britain was represented by Sir Edward Crowe, the new Comptroller-General of the Department of Overseas Trade; Mr. J. R. Cahill, of the British Embassy, and Lieutenant-Colonel Cole, of the Department of Overseas Trade. The delegates were accompanied by Mr. Guy Locock, of the F. B. I.; Mr. R. B. Dunwood, of the Association of British Chambers of Commerce, and by Mr. L. A. de L. Meredith, of the Department of Overseas Trade.

THE first Congress of the Pan-American Medical Association opened at Havana on December 22. It is hoped that the congress will promote good-will and a better understanding between English and Spanish-speaking medical men. Five days of business sessions and two of sightseeing and entertainment have been planned by the Cuban organizing committee. All meetings and conferences are being held at the Havana Academy of Sciences. A special campaign is being made to bring the leading physicians of the interior to Havana for the week's congress. Special excursion trains are to be run on the opening and closing days of the conference. Among the speakers will be Drs. Edward Hume, director of the New York Postgraduate Medical School and Hospital; J. J. Valentine, Gardner R. Ridlow, W. E. Weeks, president of the Society of Tropical Medicine; J. Eastman Sheehan, and Harold S. Vaughan, Samuel J. Kopensky and Lee M. Hurd, all of New York, and Dr. William J. Mayo, of Rochester, Minn.

THE International Congress of Tropical Medicine and Hygiene, arranged by the Egyptian government in connection with the centenary celebrations of the Faculty of Medicine at Cairo, met in Cairo on December 15. Sectional meetings were held in connection with the following subjects: Anatomy and anthropology, physiology, pathology, bacteriology, pharmacology, parasitology, forensic medicine, pharmacy and dentistry. Meetings, including operations and demonstrations, will take place in connection with: Surgery, medicine (tropical diseases), gynecology, ophthalmology, radiology, ear, nose and throat diseases, children's diseases, skin and venereal diseases. The work of the congress was carried on in the following sections: Tropical medicine (including diseases of children), tropical surgery (including gynecology), tropical ophthalmology, tropical hygiene and sanitation, parasitology, pathology and bacteriology. Papers and addresses were read in Arabic, English, French, German and Italian. During the congress the foundation-stone of the new hospital and medical school to be built in Cairo was laid by King Fuad on the northern part of Roda Island, in the Nile. The president of the Royal College of Surgeons, Sir Berkeley Moynihan, presented the diploma of honorary fellowship to Dr. Aly Bey Ibrahim at the congress.

THE ninety-seventh annual meeting of the British Medical Association will be held in the latter part of July, 1929, in Manchester, under the presidency of Dr. Arthur Burgess, professor of clinical surgery in the Victoria University of Manchester. The clinical and scientific work of the meeting will be divided among nineteen sections.

WE learn from *Nature* that it has been decided that the eighty-eighth annual general meeting and the anniversary dinner of the Chemical Society shall be held in Leeds on Thursday, March 21. It is the desire of the council to make this a special occasion for a general gathering of chemists and those associated with chemistry in the north of England, and in order that these meetings may be representative of all branches of chemistry and chemical industry, the local sections of the Society of Public Analysts, the Institute of Chemistry, the Society of Chemical Industry, the Society of Dyers and Colourists, and the Coke Oven

Managers' Association are cooperating. The annual general meeting will be held in the University of Leeds on Thursday, March 21, and the anniversary dinner will take place in the Town Hall, Leeds, the same evening. The Railway Clearing House has granted facilities by which those attending the meetings will be able to travel from all parts of Great Britain to Leeds at the reduced rate of an ordinary fare and one third for the double journey.

THE Metropolitan Life Insurance Company has appropriated $10,000 for the study of influenza. The study will be conducted by the company's influenza commission, of which Dr. M. J. Rosenau, professor of preventive medicine and hygiene in the Harvard Medical School, is chairman. The commission was formed originally to help combat the influenza epidemic of 1918 to 1919.

UNIVERSITY AND EDUCATIONAL NOTES

A GIFT of $500,000 has been made to Washington University for an institute for research and study of eye, ear and nose diseases as a memorial to Oscar Johnson, one of the founders of the International Shoe Company. The institute will be under the direction of Dr. Harvey J. Howard, formerly director of the eye department of the Rockefeller Medical School in Peking. Teaching will be directed by Dr. Lee Wallace Dean, formerly dean of the medical school at the University of Iowa.

DR. JACOB GOULD SCHURMAN, American Ambassador to Germany, presented to Heidelberg University on December 18 a gift of more than $500,000 from friends of the university in the United States. Dr. Schurman was made an honorary citizen of Heidelberg, where a half century ago he entered the university as a student.

TRUSTEES of the Rockefeller Foundation have placed $170,000 at the disposal of the University of Utrecht to establish a school of physiology.

THERE has been completed and occupied at Iowa State College a new building for dairy industries, which with its equipment cost $500,000. It was formally dedicated on November 14.

HUGH M. HENTON, formerly assistant professor of metallurgy and mining at the Washington State College, has become associate professor of metallurgy at the Alaska Agricultural College and School of Mines.

DR. WERNER GERLACH, of Hamburg, has been called to a professorship of pathology in the University of Halle.

DR. OSCAR B. MUENCH has accepted the position of head of the department of chemistry and physics of New Mexico Normal University, East Las Vegas, New Mexico.

PROFESSOR POETZL, of Prague, has succeeded Professor Wagner-Jauregg as head of the psychiatric clinic at Vienna.

DISCUSSION AND CORRESPONDENCE

PYREX GLASS AS A RADIUM CONTAINER

RECENTLY Dr. L. F. Curtis described in *Nature* (Vol. 120, p. 406, 1927) his experience at the Bureau of Standards in using pyrex glass to store a solution of radium salt containing 140 milligrams of the element. After a year and a half of use he found a network of fine cracks developed in the glass container above the water-line, which were therefore attributed to the effect of alpha ray bombardment. The flask was otherwise intact and had remained gas tight.

Having just previously prepared in this laboratory a system in pyrex glass for the collection of radon (emanation) from a solution of chloride containing 265 milligrams of radium element, it was decided to attempt to employ pyrex for one year—with all due safeguards in case of its failure.

The experiment, which has been completed without accident, confirms Dr. Curtis's results in every respect. The object of the present note is to give some additional details which may be significant in interpreting the effect

Not only was a longitudinal system of fine closely spaced cracks developed in the upper part of the 250 cc flask in the area extending for an inch below the neck, but larger cracks less frequently spaced extended longitudinally downward exactly to the water-line (the flask was half filled) which were crossed by large transverse cracks extending almost continuously around the flask. Just below the neck (one half inch in diameter) and also near its top where it was constricted to connect with quarter inch tubing leading to the purification system, spiral cracks had formed, passing several times around the tube with regular spacing of about 1 mm.

From inspection of the system, the writer concluded that the cracking was probably due to the gradual relief of preexisting strains in the glass, by a process of expansion under alpha radiation. The expansion may have been caused or assisted by chemical action produced in the glass by alpha rays, such as the decomposition of water. On the other hand, ordinary soda-lime glass which also contains water does not crack, and presumably, therefore, does not contain strains to the same degree. It should be mentioned that there is some evidence of incipient scaling on the

inner glass wall accompanied by interference colors, which has suggested to others that the forces might be those of contraction rather than expansion, and probably produced by, rather than merely relieved by, alpha ray bombardment.

Two factors seem to control the process, intensity of radiation and degree of strain. For example, the walls of the connecting tubing showed no cracks, on account of the smaller volume of radon contained per unit of area, but nevertheless careful examination disclosed a single crack at a point where a joint and again where a bend had been made, both at points of extra stress.

A few of the larger cracks had come all the way through the wall to the surface, although the alpha rays penetrate only about .002 mm.

For future radium collection an ordinary glass flask has been substituted. The graded joint to the rest of the pyrex system is kept covered by mercury, except during actual collection, to avoid prolonged exposure to alpha rays.

Both Rutherford and Mme. Curie long ago found that fused silica is not a suitable container for radium, owing to its cracking. It is, therefore, interesting to find this same quality in glass of high silica content but not in ordinary glass of lower content.

S. C. LIND

SCHOOL OF CHEMISTRY,
UNIVERSITY OF MINNESOTA

A NEW TERM FOR THE 10^{-8} CENTIMETER UNIT

ONE of my favorite indoor sports consists in attending meetings of societies devoted to the physical sciences, and listening to the pronunciation by different speakers of the Swedish word ångström, used to designate the 10^{-8} cm unit. Although the correct sound is something like *awngstrem*, at least 75 per cent. of American scientists, including not a few Nobel prize winners (of all people!), shift the vowels and render it *engstrawm*. In print this word also suffers, being sometimes spelled with a simple *a*, and sometimes even with *e*. Some organizations have indeed adopted *a.u.* as the official abbreviation, thus obscuring its derivation.

One way to deal with this situation would be to obviate entirely the necessity of using the word, and the proposal is therefore made here that units of 10^{-8} cm be given a new designation, namely atom-meter, with the abbreviation *am*.

The following advantages are possessed by the proposed symbol. It is one character shorter than the widely used *a.u.*, yet differs from this so little that substitution of the one for the other could be carried out with a minimum of misunderstanding. It does not commit an error in transliteration, but starts with the same vowel as the word for which it stands. And it fits into the international series of designations for units of length, adding to the series *km*, *m*, *dm*, *cm*, and *mm* one more roman-character abbreviation.

EDGAR T. WHERRY

WASHINGTON, D. C.

THE EXCELSIOR GEYSER, YELLOWSTONE NATIONAL PARK

IN an article describing a new geyser in Yellowstone National Park[1] it is stated that the old Excelsior Geyser has been extinct since 1888.

In the summer of 1890 I was directed by Professor Richard Rathbun, in charge of scientific investigation of the U. S. Fish Commission, to join Professor S. A. Forbes in a survey of the lakes and streams of Yellowstone National Park.

We arrived at Cinnabar on the seventeenth of July and spent our first night in the park in camp at Swan Lake Basin, about four miles from the Mammoth Hot Springs Hotel, a short distance south of "Golden Gate." The following night we camped on Canon Creek, a small tributary of Gibbon River.

At about 8:30 on the morning of the nineteenth we reached what our guide, Elwood Hofer, called Teton Hill, so named, he said, because the Teton Mountains were here visible. The Lower Geyser Basin lay at our feet, and one peak of the Tetons could be seen far to the south. At one point a column of steam was rising which we estimated to be from eight hundred to one thousand feet in height. Hofer identified this steam as coming from Excelsior Geyser, which he said had been inactive since 1888.

Two hours and a half later we arrived at the Excelsior Geyser and learned that there had been eruptions in the night and morning and that the steam which we had seen from Teton Hill had risen from the last eruption. Here, also, Hofer's statement that the geyser had not been active since 1888 was confirmed.

On August 18, Professor Forbes and I were collecting on Fire Hole River from the Upper to the Lower Geyser Basins. The following extracts from notes made at the time may not be without interest in this connection.

At the bridge just below Riverside Geyser, the temperature of the water, eighty feet down stream from the bridge, near shore on the geyser side of the stream, before the eruption was 17° C. During the eruption it rose to 21°. At the center of the stream before eruption it was 15°, during eruption 16°; on the opposite side before eruption 15°, during eruption

[1] *Science Newsletter*, August 11, 1928, p. 76; SCIENCE, August 17, 1928, p. xii, of *Science Supplement*.

no change. A few minutes later the temperature of the middle and opposite sides of the stream was 16°, on the geyser side 17°.

At the foot-bridge, one hundred yards down stream from the overflow of Excelsior Geyser, shortly before an eruption took place, the temperature of the water on the geyser side in shallow water was 35°. A little farther out in deeper and swifter water, 32°; on the opposite side near shore 22°. Here the water was unmixed with geyser water and the bottom was dark colored. Where warm water runs the bottom is lighter colored. Soon after these temperatures were taken there was an eruption of the geyser, when a large flow of boiling hot water entered the stream. Immediately after the eruption near the geyser shore the temperature was 55° at the point where it had been 35° before the eruption. On the opposite side of the stream near shore there was no change of temperature.

Life, both animal and plant, had been killed by the hot water in the center and on the geyser side of the stream for a distance of probably as much as a half mile down stream. On the opposite side of the stream neither animal nor plant life had been affected by the hot water. For example, tubes of caddis-fly larvae, built of pine needles, and suggesting the stick-chimneys of log-cabin days, were abundant on stones everywhere on the bottom of the stream from shore to shore. The larvae in tubes on the side of the stream opposite the geyser were living and active. Those in the middle of the stream and on the geyser side were dead.

Some idea of the immense volume of water which enters the Fire Hole River from Excelsior Geyser may be formed when it is noted that the stream at this point is nearly one hundred feet wide, with an average depth of some eighteen inches and with a swift current.

Some fifteen or twenty minutes after the eruption the warm side of the stream had cooled down to 23°.

EDWIN LINTON

ZOOLOGICAL LABORATORY,
UNIVERSITY OF PENNSYLVANIA

INTERMITTENT VISION

IN SCIENCE for October 26, Dr. Harry S. Gradle asks for an explanation of phenomena which he observed as a passenger on the air mail. In a later issue of SCIENCE Professor Gaehr and Mr. Packard describe phenomena which they believe to be of the same general class. In explanation of the phenomena described by Dr. Gradle I have the following comments to offer:

(1) When successive impressions are given to any portion of the retina at a rate which produces a fused or continuous sensation, a quick lateral movement of the eye causes momentarily a resolution of the fusion into the component sensations. For example, if blue and yellow sectors are combined to gray on a rotary color mixer, a quick movement of the eye momentarily resolves the gray surface into the component blue and yellow sectors. The reason for this is obvious. The movement of the eye momentarily interrupts the succession of the impressions on any given portion of the retina, therefore the combination of impressions is prevented and the components are sensed as separate. This resolution of the fusion into its component sensations can be produced in other ways which interfere with the succession of impressions on the same portion of the retina, *e.g.*, by moving a pencil or light wand rapidly back and forth between the eye and the rotating disk near to the surface of the disk, by rotating a sector or sectors in front of the disk, etc. From these considerations we would expect the blades of the propeller to become momentarily visible when a quick lateral movement of the eye is made.

(2) The rate of succession needed to give a uniform, continuous sensation varies from the center to the far periphery of the field. Over portions of the peripheral field a more rapid rate of succession is needed to obliterate all trace of separateness of impression than is required at the center of the field. Over such portions of the field one would expect therefore to see the blades of the propeller in a flickering succession when the rate of rotation is sufficiently high to produce a fused or continuous impression at the center of the field. These conditions would apply to Dr. Gradle's observation in case an excentric fixation was taken and held.

(3a) With a far fixation and relaxed accommodation the size of the pupil is increased, the amount of the increase varying with the intensity of illumination present. An increase in the size of the pupil would cause a proportionate increase in the amount of light entering the eye. With increase of intensity of light the rate of speed of succession needed to give a continuous impression is greater. An increase of intensity of light due to an expanded pupil should therefore tend to resolve a continuous impression into a flickering succession of impressions. (b) An increase of intensity of light also causes an increase in the difference in sensation aroused by two surfaces of a given difference in coefficient of reflection. This would tend to increase the visibility of small and shadowy physical differences in the field in objects not near the threshold of acuity.

(1) and (2) above are based on direct experimental evidence. (3) is an inference from experimental data at my command.

From the descriptions given it is not clear that the phenomena described by Professor Gaehr and Mr. Packard are of the same class as those described by Dr. Gradle. A momentary appearance of the spokes of a rapidly rotating wheel which might be described as stationary may be caused by an eye movement, voluntary or involuntary, in which case the explanation falls under (1) given above. It is possible, however, that there is presented here a special case of a phenomenon which has been variously called the Purkinje after-image, Bidwell's ghost, recurrent vision, etc. The variations in this phenomenon which may be produced by varying conditions are well known to be numerous and complicated and the pulses of sensation which occur are at least remotely suggestive of the possibility of stroboscopic effects.

C. E. FERREE
WILMER OPHTHALMOLOGICAL INSTITUTE,
THE JOHNS HOPKINS MEDICAL SCHOOL

QUOTATIONS

THE MINIMUM LIVING SALARY OF THE PROFESSOR

A RECENT contribution to SCIENCE presents for inspection the budgets of 50 per cent. of the married members of the University of California faculty. The schedules of ninety-six householders were available. The average family consisted of 3.5 persons, and the expenditure of this fractional group averaged $5,000 per annum.

Needless to say, salaries alone did not provide this amount: indeed, in three quarters of the cases salaries did not pay for the goods and service regarded as necessaries. Seventy-five per cent. of the faculty families had to supplement the professional wage with other earnings. The mean cost of living for the ninety-six households proved to be $5,511.77; generally speaking, the professors spent $7,000 and the instructors $4,000.

To summarize: These families, at every income level, spent 17 per cent. of their budget on food, 17 per cent. for shelter, 9 per cent. for clothes (in 40 per cent. of the cases the wives spent less than their husbands), and for the items of investments, automobiles, health, recreation and dependents outside the home an average of one fourth to one third of the total expenditure; 57 per cent. had automobiles, one third had dependents outside the home. House operation took 13 per cent., though no family living on less than $6,000 had full-time domestic help. Education took 1.5 per cent. of the total; church, charity and tobacco absorbed less than 1 per cent. The standard and cost of living disclosed in this article are minimum for professional men; $5,000 was the minimum cost of health and decency, yet in most cases it was obtained only by extraordinary exertions.

These are home truths for members of the teaching profession, but they apply with only slightly diminished force to members of other professions and to married graduates from two to twelve years out of college who have not yet had time to become established in their calling. The salaries of young men in any profession have shown little or no response to the increasing cost of living. And, to make up the deficit, the wage-earning wife is, at best, a happy accident. For young couples, whether in the teaching profession or not, the problem of how to live on $5,000 a year—with a household of three and a half persons more or less—has never been more acute. There is some compensation perhaps in the fact that professors and, as one might say, other men of parts are in the same boat, but no comfort at all in the reflection that Mr. Ford and other high-paying industrialists, by raising the standard of wages, have boosted the cost of living and made the going even rougher than usual for the poor professional man. Even worse off, probably, are the hundreds of thousands of Americans who are employed in unskilled, non-unionized occupations and have no opportunity to increase their incomes.—*The Harvard Alumni Bulletin.*

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN EGG SHELL VALVE

DURING and since the World War more research has been done upon the various phases of the physiology of the respiratory system than in all the previous history of physiology. In the study of many respiratory phenomena it has been found necessary to control the direction of air currents by means of valves. Even though a considerable number of types of valves has been described for this purpose, the writer wishes to present another which has proved quite satisfactory. The valve itself consists of the dried shell of a hen's egg which has been rendered impervious to water by several coats of celluloid cement.

After opening the large end of the egg to remove the contents the shell is thoroughly dried, coated several times with a cement made from celluloid dissolved in acetone or other nitro-cellulose product, dried and trimmed with small scissors to the shape shown in Figure 1, *B*. Any rough edges may be repaired by binding with lens paper moistened with the cement. The shell is then fitted with an aluminum wire stem and a cork counterpoise as shown in the figure and is ready for use.

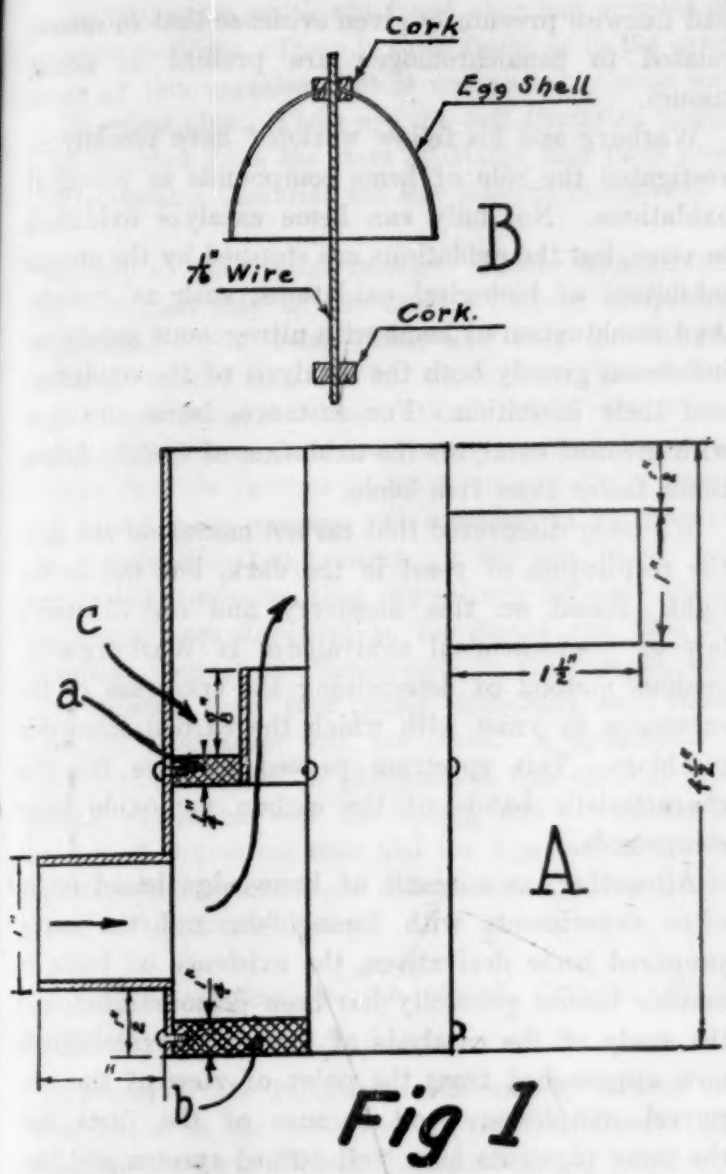

Fig 1

The valve chamber, Figure 1, *A*, consists of a short length of nickeled brass pipe cut from what plumbers designate as a two-inch tank L. This pipe is fitted with two brass discs, *a* and *b*, the latter of which closes the lower end of the chamber while the former forms the floor of the circular mercury well, *c*. As shown in the figure, a short length of one-inch brass pipe soldered in place serves for the inner wall of the mercury well. The discs, *a* and *b*, may be held in place by means of round head brass screws or may be soldered.

The direction of the air current is shown by means of the arrows. The entrance and exit tubes are of one-inch brass tubing. Before assembling for use the interior of the valve chamber must be thoroughly coated with hard paraffin or beeswax to prevent the mercury from corroding the soldered joints. The valve chamber may be readily held in its proper position by means of one or more screws passed through the disc *b*. In this laboratory the two valve chambers and the absorber chamber are compactly assembled upon a brass plate which in turn is supported by short pipe legs and mounted upon a wooden base by means of stove bolts. The upper end of the valve chamber is closed by means of a No. 11 rubber stopper. This allows for convenient examination and adjustment.

ALVAH R. MCLAUGHLIN
DEPARTMENT OF PHYSIOLOGY AND PHARMACOLOGY,
MICHIGAN STATE COLLEGE

SPECIAL ARTICLES

THE HEME COMPOUNDS IN NATURE AND BIOLOGICAL OXIDATIONS[1]

THE new knowledge of the existence and function of the heme compounds in aerobic tissues generally brings together two problems which at first sight seem far apart, the problem of the peculiar biological distribution of the hemoglobins, which are found only in a few groups of unrelated animals, and the problem of the nature of the iron compounds which catalyze biological oxidations.

Heme is the iron pyrrol complex which is joined to the protein, globin, in hemoglobin. It may be prepared in the form of its crystalline chloride, hemin. The blood of every vertebrate contains hemoglobin. Without such a pigment the large active vertebrates could not exist. But outside of the vertebrates hemoglobin occurs only here and there and in the most widely different animals. Its completely haphazard distribution does not follow at all the genetic relationships. Apparently a very complicated substance has arisen independently in nature again and again. Apparently when an individual species requires hemoglobin it can create heme to fill its need.

The ordinary fuel substances which are very stable when exposed to air *in vitro* are burned in the living organism with great ease due to the aid of catalysts. It has been believed that heavy metal compounds, in particular iron compounds, are concerned in this catalysis. But the only fact that has been known about the nature of the iron compounds which exist in all tissues is that one can not get a test for free inorganic iron. Yet the properties, catalytic and otherwise, of an iron compound depend t a great extent on the nature of the complex to which the iron is attached. Small changes in the nature of the complex can cause big changes in the powers of the catalyst.

The conclusion we wish to present is that the iron pyrrol complex, heme, is present not only here and there as a constituent of hemoglobin, but in the oxygen-consuming tissues of animals and plants generally, and that the heme compounds in nature are intimately concerned with the catalysis of biological

[1] Based on a lecture given in Evanston, Illinois, on August 11, 1928, before the Institute of Chemistry of the American Chemical Society.

oxidations. Hemoglobin, then, is to be regarded as a specialized and occasional derivative of the universal heme. And in the study of biological oxidations we must now operate not with the vague idea of iron compounds, but more specifically and more profitably with the iron pyrrol complexes of the heme family.

The first proof[2] that heme identical with the heme of hemoglobin exists in tissues outside of hemoglobin, was an application of our work on the nature of hemochromogen[3, 4]. Every hemochromogen, as we had shown, is a compound of heme and some nitrogenous substance. The exact properties of a hemochromogen, in particular the exact positions of its sharp absorption bands, depend on what nitrogenous substance it contains. Furthermore, there is always the equilibrium

$$\text{Hemochromogen} \rightleftarrows \text{Heme} + \text{Nitrogenous substance}$$

If there is added to a hemochromogen containing the unknown nitrogenous substance X the known nitrogenous substance pyridine, which has a great affinity for heme, there results

$$\text{X Hemochromogen} + \text{Pyridine} \rightleftarrows \text{Pyridine hemochromogen} + \text{X}$$

By the addition of enough pyridine the reaction is driven to the right; X is displaced.

If pyridine is added to yeast, a two-banded pigment is obtained which is indistinguishable in respect to the position of its bands from the pyridine hemochromogen obtained by adding pyridine to crystalline hemin prepared from hemoglobin. We conclude that yeast contains heme and that any nitrogenous substance combined with the heme has been displaced by pyridine. Our conclusion has recently been confirmed by Fischer and Schwerdtel,[5] who have isolated hemin from the pyridine extract of yeast.

We were led to this experiment by the demonstration by Keilin[6] that cytochrome is present in a great variety of tissues and that the components of cytochrome have some of the properties of hemochromogens, although they are not identical with the hemochromogen prepared from hemoglobin. MacMunn[7] had likewise previously given evidence that substances related to hemochromogen are present in animal tissues.

Warburg and his fellow workers[8] have recently investigated the rôle of heme compounds in biological oxidations. Not only can heme catalyze oxidations *in vitro*, but the oxidations are stopped by the specific inhibitors of biological oxidations, such as cyanide. And combination of heme with nitrogenous substances influences greatly both the catalysis of the oxidations and their inhibition. For instance, heme combined with nicotine catalyzes the oxidation of cystein fifteen times faster than free heme.

Warburg discovered that carbon monoxide can stop the respiration of yeast in the dark, but not in the light. Based on this discovery and on Einstein's law of photochemical equivalence is Warburg's ingenious method of determining the spectrum of the substance in yeast with which the carbon monoxide combines. This spectrum proved to have the two characteristic bands of the carbon monoxide heme compounds.

Altogether, as a result of knowledge based on *in vitro* experiments with hemoglobin and the easily prepared heme derivatives, the existence of heme in aerobic tissues generally has been demonstrated, and the study of the catalysis of biological oxidations is now approached from the point of view of the iron pyrrol complexes. And because of the facts that the heme pigments have well-defined spectra and that their compounds with carbon monoxide are sensitive to light, biological oxidations can now be studied by new and powerful photochemical methods. In regard to hemoglobin itself, a new insight has been gained into its place in the economy of nature. Hemoglobin is a specialized derivative of the universal heme.

M. L. ANSON
THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, PRINCETON, N. J.

A. E. MIRSKY
THE HOSPITAL OF THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, NEW YORK CITY

[2] M. L. Anson and A. E. Mirsky, *J. Physiol.*, 60: 161 (1925).

[3] M. L. Anson and A. E. Mirsky, *J. Physiol.*, 60: 50 (1925).

[4] M. L. Anson and A. E. Mirsky, *J. Gen. Physiol.*, 12: 273 (1928).

[5] H. Fischer and F. Schwerdtel, *Z. Physiol. Chem.*, 175: 248 (1928).

[6] D. Keilin, *Proc. Roy. Soc., Series B*, 98: 312 (1925).

[7] C. A. MacMunn, *Phil. Trans. of Roy. Soc.*, 77: 267 (1886).

[8] O. Warburg, *Die Naturwissenschaften*, 16: 345 (1928). SCIENCE, 68: 437 (1928).

THE NATIONAL ACADEMY OF SCIENCES. III

The Cambrian in northern Maine: EDWARD S. C. SMITH. A thick series of folded slates and sandstones is found along the banks of the east branch of the Penobscot River in Township 5, Range 8, Penobscot

County, Maine, in which are found abundant remains of *Oldhamia occidens*. There is some doubt as to the exact nature of this organism, but it was probably some sort of calcareous alga. These are the first Cambrian fossils to be reported from the state of Maine, and their presence indicates a Cambrian sea way hitherto unreported.

Geology of the Capitol District: RUDOLF RUEDEMANN. The geological map of the Capitol District comprising the Schenectady, Cohoes, Albany and Troy Quadrangles has been finished this fall by the writer. The formations range from the Lower Cambrian to the Upper Devonian and were deposited in two parallel basins or troughs that are portions of the Levis and Chazy basins that in the north compose the Appalachian geosyncline. The investigation has brought out the astonishing fact that during Ordovician time two entirely different sets of formations were deposited in the basins and that the deposition took place alternatingly in the troughs, each basin having been four times submerged and raised again, in alternation with the other. A hypothesis to explain this remarkable phenomenon was offered. The Taconic revolution with its folding and overthrusts at the end of Ordovician time and the Appalachian revolution were briefly mentioned and the effect of the glacial period on the district noted.

Problems relating to the Grand Canyon: J. C. MERRIAM.

A census of the Pleistocene mammals of Rancho La-Brea, based on the collections of the Los Angeles Museum, by Chester Stock: J. C. MERRIAM.

Further studies on the influence of a power dam in modifying conditions affecting the migration of salmon: H. B. WARD (introduced by S. A. Forbes).

Sex control in a daphnid: ARTHUR M. BANTA and L. A. BROWN. It is well known that in most animals there is a sex-determining mechanism, the so-called sex-chromosomes, and that the sex to be developed from an egg depends upon whether a female- or a male-determining sperm has effected fertilization. Even in parthenogenetic organisms, in which the egg develops without fertilization, sex is known in some cases to conform with the distribution of the sex-chromosomes. But there are certain cases in which sex-determination does not readily seem to fall under the operation of such a mechanism. One of these apparent exceptions has been the daphnids. In these prevailingly parthenogenetic species, both females and males are produced from unfertilized eggs which have not had chromatic reduction. Mothers under normally favorable conditions produce only daughters. If mothers (*Moina macrocopa*) are crowded, are reared at low temperature (11° to 14° C.), or are otherwise (as by treatment with drugs) subjected to certain conditions which retard their development, their eggs instead of developing into exclusively female offspring, develop into young, all or a considerable percentage of which are males. It is clear then that sex in this animal is subject to control by environmental factors. Control measures to be effective must be exercised during a definite period —about four hours before the eggs are laid. After this critical period for sex-control the sex is fixed and is no longer subject to control measures. It is an interesting and probably significant fact that this critical period occurs apparently about three and a half hours before the beginning of the single maturation division of the egg; and it is at the maturation division that the sex-chromosome mechanism, if existent in these forms, should operate to determine the sex of the forthcoming young. Although no sex chromosomes have been discovered in this exceedingly difficult cytological material, it is probable that the sex-control which we have accomplished through environmental factors operates through *control of a sex-determining mechanism*. There are, to be sure, alternative possibilities, (1) that there is no sex-chromosome mechanism in these organisms, or (2) that environmental conditions override the sex-determining mechanism or (3) that there is some internal mechanism still more fundamental than the sex-chromosome mechanism. But the evidence suggests, and on the whole it seems safer to assume, that we are working through a sex-chromosome mechanism. Sex control is of much practical and sentimental interest. The case here discussed and other similar cases, as they are analyzed, serve to still further emphasize the probable universality of the sex-chromosome mechanism. Obviously if sex is to be controlled in higher animals the sex-chromosome mechanism must be taken into account. If it were possible to control the type of sperm, whether a female-determining or a male-determining sperm, which fertilizes an egg the sex of the resulting individual might thereby be controlled. Unless and until such control is accomplished, sex-control in higher animals seems beyond the possibility of attainment.

Late geologic deformation of the Appalachian Piedmont as determined by river gravels: MARIUS R. CAMPBELL. The high land in the Piedmont region of Maryland and Pennsylvania has long been a puzzle to geologists and geomorphologists and some advanced the idea that it is due to recent crustal deformation, but as no positive proof of this proposition was adduced, it has remained an unproved hypothesis, until the writer conceived the idea that it might be demonstrated by a study of the river gravels which are known to abound in this region.

These beds, known by the names of Bryn Mawr and Brandywine, are of late Tertiary age. They were first studied by the writer on Potomac River in and about the city of Washington, but the results, although indicating crustal movement, did not furnish positive proof that it had occurred. The writer then waited for an opportunity to test his method on streams farther north. This opportunity came during the past summer and the results seem so conclusive that he presents them here for the consideration and criticism of others.

The evidence secured on Susquehanna River is the most satisfactory and will be given first. On this

stream the Bryn Mawr, which is the older of the two gravel beds, is well shown in the vicinity of Havre de Grace, Md., at an elevation of 400 feet above sea level, and the Brandywine gravel at an elevation of 300 feet. Throughout the gorge of the river, or from Havre de Grace to Columbia, Pa., the Brandywine gravel, as determined at many places, is nearly horizontal, ranging from an elevation of 300 feet at the mouth of the river to 360 feet at Columbia; but the Bryn Mawr gravel forms a low broad arch, rising from an elevation of 400 feet at the mouth of the river to 660 feet at Safe Harbor, Pa., and thence descending to about 550 feet at Columbia. Above Columbia the Brandywine gravel is nearly level as far as Harrisburg, some 70 miles above Havre de Grace, and the Bryn Mawr gravel descends slightly until, in the vicinity of Middletown, Pa., it reaches an elevation of about 480 feet. This elevation is held for a few miles and then, near Harrisburg, the gravel begins to rise up the river in accordance with the known deformation of the Appalachian region.

The flatness of the Brandywine gravel and the decided arch of the Bryn Mawr gravel show conclusively that after the deposition of the latter and before the former was laid down, an uplift occurred which raised the Bryn Mawr gravel at Safe Harbor 260 feet above its position at Havre de Grace and at least 180 feet above its level at Middletown; and as both beds are of late Tertiary age, the uplift of the anticline must have occurred also in that epoch.

The Potomac and Schuylkill rivers yielded similar results, showing that the Bryn Mawr gravel has been uplifted, but the fold is lower and also narrower than it is on the Susquehanna River. When platted on a map the axis of this fold crosses Susquehanna River just above Safe Harbor, Potomac River above Great Falls, and probably crosses Schuylkill River near Norristown. It is best developed on the Susquehanna, and from this point it probably plunges in both directions, disappearing to the south as an anticlinal fold about 20 miles south of Fairfax, Va., and to the east about 8 or 10 miles east of Norristown, Pa.

The growth curve of the suckling mouse: E. CARLETON MACDOWELL. The many secondary variables that influence the processes of growth complicate the study of its innate limitations. The method of averages has been relied upon to eliminate the effect of these secondary variables, and much theorizing has been based on the assumption that average curves of populations represent the innate chemistry of growth. But averages do not unmask the innate processes, because the secondary variables are in the nature of limitations and so tend to act in one direction. The nature of the innate processes is concealed to the extent that any of these variables is working. Hence they must be eliminated in other ways than by averages. Since the prenatal growth of a mammal takes place under conditions more uniform than are found in any other period, the study of the growth of embryos offers the best opportunity to observe the type of curve determined by innate processes. Such a study based upon nearly 1,000 mouse embryos raised under carefully defined conditions yields a growth curve in the form of a continuous parabola of the form $W = Kt^n$ in which W is the weight at age t counted from the appearance of the anlagen of the embryo. In post-natal life the most uniform conditions can be secured during the nursing period—the first two weeks after birth. But the curves published for the suckling mouse are not parabolas; instead they show a rise in the absolute increments during the first week with a decline during the second week, thus forming what has been called the infantile growth cycle. This paper presents data showing that under normal conditions the limiting factor in the growth of the nursling mouse is the quantity of mother's milk. When this limitation is removed, the growth which produces a fourteen-gram mouse in fourteen days follows a continuous parabola throughout the whole period. The regularity and consistency of the individual curves may be taken to indicate that in these curves the limiting factor is the innate process of growth. Thus at least one of the typical mammalian growth cycles is not due to the nature of the growth processes but to an external variable—the quantity of food. At fifteen days an abrupt change in slope is immediately related to the shift to solid food. Growth, under the same conditions of life, proceeds in a continuous manner; coincident with a change in the conditions of life, as at birth and at weaning, the rate of growth changes, but the same mathematical law describes the progress of growth under the new conditions, and the innate processes are of the same nature.

The Antillean spider fauna—a study in geographic isolation: ALEXANDER PETRUNKEVITCH. Peculiarities in the methods of distribution of spiders make the study of geographically isolated faunas, such as the Antillean, not only interesting in itself but of value in its bearing upon general problems of evolution. The present paper is based on the study of new and extensive collections of spiders from Porto Rico, Jamaica, Guadeloupe and Dominica. While the study is still in progress, sufficient material is available to draw the following conclusions. There are two distinct Antillean faunas, that of the Greater Antilles and that of the Lesser Antilles. The former represents the eastern outgrowth of the Central American fauna presumably by way of an earlier land-connection. The fauna of the Lesser Antilles has South America and particularly Venezuela for its origin and developed along the path of the air-currents, especially of the hurricanes. In Porto Rico we find the last traces of this fauna, admixed to the fauna which came from the west. Species characteristic of certain islands and not found anywhere else, wherever chance importation is reasonably excluded, may be regarded as having originated on the respective islands and are therefore indicative of the evolutionary trend of such isolated faunas. There is no evidence of any kind to show either the influence of the trade winds on the Antillean fauna or even a distant relationship between the latter and the African fauna.

SCIENCE NEWS

Science Service, Washington, D. C.

ARTIFICIAL RUBBER

COPIES of the two new patents taken out in Germany and England for making rubber artificially have been received by the U. S. Department of Commerce. The sensational announcement made a few months ago by Dr. von Weinberg, of the German dye trust, at the annual convention of the German Union of Chemical Industries, that synthetic rubber would "soon appear on the world markets as a commercial commodity, equal to natural rubber and cheaper in cost" aroused the curiosity of American chemists and tire makers, but the text of these patents will not satisfy them since they relate merely to the improvement of the final stages in the process of the conversion of well-known chemicals into caoutchouc and do not disclose any cheaper source of the raw material.

The only apparent novelty in the new process is in the methods of carrying out the combination of chemicals. In one patent they are suspended in water thickened with something like soap, starch or egg albumen at 150 degrees Fahrenheit, while a stream of oxygen gas is passed into the emulsion. According to the other patent dried isoprene is mixed with metallic sodium in glycerine in the atmosphere of carbon dioxide, and agitated until rubber results.

If the method of oxidizing an emulsion results in artificial rubber having the peculiar colloid structure of the latex of the rubber tree the product may possess the elasticity that has hitherto been lacking in the laboratory products. The materials mentioned, isoprene and related hydrocarbons, can be made from various known sources, such as petroleum, potatoes, tar, coal, corn, etc., but no process so far published will turn them into rubber as cheaply as it can be grown on plantations. If the great German chemical combine, the Interessengemeinschaft Farbenindustrie, is able to accomplish this it is most likely done in connection with their plants for the production of synthetic petroleum by the hydrogenation of coal.

The Soviet Government offered a first prize of $50,000 and second prize of $25,000 for five pounds of synthetic rubber with the recipe delivered at Moscow before January 1, 1928, but no announcement of the awards has yet been made. Another prize of $25,000 was offered sometime ago through the London *Financier* for a method of making rubber cheaper than sixty cents a pound but no claimant appeared for the prize.

SEPARATION OF THE VITAMIN "BIOS"

"BIOS," a substance that promotes growth in yeast as vitamins do in animals, has been demonstrated to be really two substances, and one of these two "bioses" has been prepared in pure crystalline form in the laboratory of Professor W. Lash Miller, of the University of Toronto. It proves to be a form of a seldom-studied but long-known chemical compound, inosite.

In 1901, long before vitamins were discovered, a Belgian chemist named Wildiers found that yeast needed for growth small quantities of some unknown substance which he could not isolate. He gave to this unknown material the name "bios," which is the Greek word for "life." After the discovery of vitamins, scientists began to take interest in this vitamin-like stuff needed by yeast, but it still defied separation and chemical analysis.

Then various researchers in Professor Miller's laboratory began a systematic attack on the problem. One of them discovered that if a bios solution were shaken up with fine charcoal some of the bios vanished into the charcoal and what was left could not help yeast to grow. The part that was left could also be cleared out of the solution by other chemical means. This indicated that there was not one bios, but two; accordingly the names Bios I and Bios II came into use.

The latest advance has been to purify Bios I into crystal form. Crystals are the chemist's test for purity; a mixture will not crystallize. The crystals obtained have been analyzed and shown to contain the same proportions of carbon, hydrogen and oxygen as common glucose, but the chemical arrangement is much more complex.

Bios I, or inosite as it has now been proved to be, is abundant in young, vigorously growing plant shoots. The German investigators who first studied inosite obtained their material from bean sprouts. The Canadian scientists who purified Bios I and established its chemical identity bought up large quantities of tea siftings for their raw material.

DEVELOPMENT OF THE AIRSHIP

REMARKABLE demonstrations of the airship will be made before the end of this year, Gilbert Betancourt, airship engineer of Detroit, predicted on June 29 to the aeronautic division of the American Society of Mechanical Engineers meeting in Detroit.

He said, "Two British airships and one German, all larger and better than any heretofore built, are to be completed and launched for demonstration flights all over the civilized world within the present year; and a naval contract for two American Zeppelins of great size is soon to be signed and construction will be started before the end of the year. A real issue before the country at the present time is whether this nation shall strive for the lead in rigid-airship development and construction, or continue trailing behind the three airship-wise European nations."

"The development of the rigid airship started in Germany some thirty years ago," Mr. Betancourt said, "and as yet there is but one such craft in this country, the *Los Angeles*, and this was built in Germany. Both Great Britain, Germany and Italy are some three to five years ahead of us in airship building since the war.

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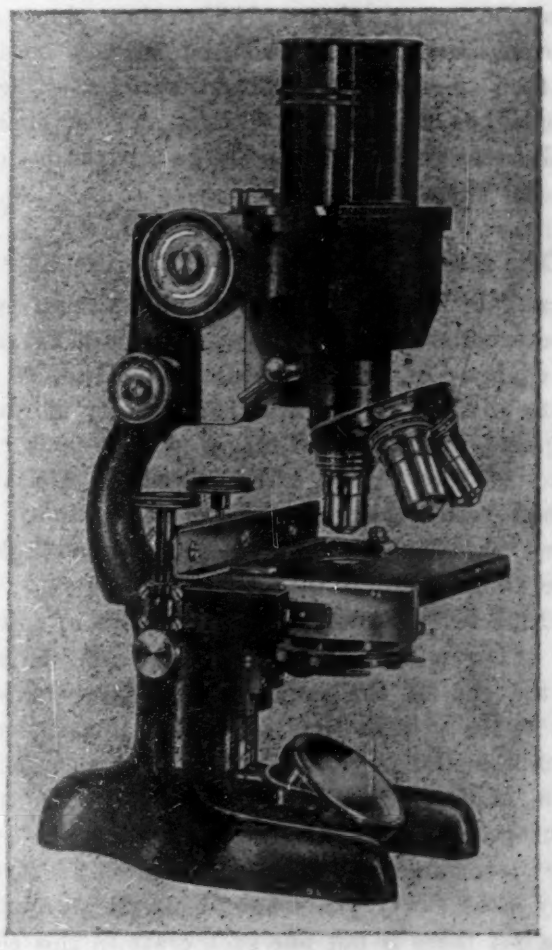

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The reasons are obvious. As a German invention, the rigid airship was energetically developed into an efficient and safe craft which was used by the Germans during the war. England was near enough to the development of this new machine to give it serious study; but America was too far away to realize the possibilities of this form of aircraft. One good rigid airship was built in this country some five years ago; since then attempts have been made to interest the government in building more, but the people of the country at large do not know yet what the airship can do, or its possible use in our transportation system. Too many people in this country form a mental picture of an airplane when airships are spoken of, and yet these two crafts are as different from each other as a kite and a balloon.

"No doubt the world-wide demonstration of the three new European rigid airships will aid materially in clarifying the practical uses of airships. But it is certainly not to our credit to lag so far behind Europe in the development of airships.

"Another serious handicap is the cost of manufacturing this type of aircraft. Either Germany or England can build a rigid airship for about half as much as we can at present, because this craft is still a largely hand-made product, and as yet machinery production methods have not been used. Our salvation will lie in expediting the development so that we can build our ships in groups of five or more from the same design, and of the same size, in order to be able to employ mass production methods and machinery. Our only ship, the *Los Angeles*, already some four years old, is small for demonstration work and though it is still doing wonderfully in the skilled hands of our little airship navy, it is so constantly employed in the training personnel that it cannot be sent over the country to show people the possibilities of rigid airships.

"With these obstacles, the handful of the airshipwise and the airship engineers of the country has turned to academic problems. New experiments, unsupported by full-size tests and demonstrations have given rise to the discussion of academic problems while neglecting the opportunity for concerted effort to secure support to build full-size ships for demonstration purposes."

A NEW GEARLESS AUTOMOBILE

A NEW transmission for automobiles that eliminates shifting of gears and automatically changes speeds was described to the Society of Automotive Engineers meeting in Quebec on June 28 by its inventor, D. Sensaud de Lavaud, a French engineer.

Automobiles run on the streets of Paris fitted with this new transmission have convinced M. de Lavaud that his device is not only sound technically but can be applied commercially to motor vehicles. Development of the transmission has required seven years.

Because with ordinary gear shift cars, the driver never operates continuously at the most efficient relation between speed of engine and wheels, M. de Lavaud claimed that the automatic transmission will increase the average speed possible and effect a fuel saving of more than 20 per cent. in general and some 40 per cent. in the dense traffic areas of cities.

A long transmission shaft is driven directly from the engine and rotates an inclined "inertia hub," which changes the rotation of the shaft into reciprocating motion. Connecting the inertia hub with the drive of the rear axle are rods which, by acting on roller ratchets, translate the back and forth thrusts into rotary motion applied by the axles to the wheels. The trick of the transmission consists in the variation of the inclination of the inertia hub with the engine torque and road resistance which automatically varies the throw of the connecting rods, consequently the rotation of the wheels and the speed of the car. This automatic transmission is combined with a gearless differential and a planetary reverse-gear located on the rear axle.

Advantages of his automatic transmission over gear transmission are listed by M. de Lavaud as follows: Ordinary down grades can be negotiated, even with full throttle, without noticeably changing the speed of the engine. It is impossible on level stretches or on upgrades to accelerate the engine beyond normal speed for the transmission. Stalled engines are impossible. The power of the automobile is controlled entirely by the throttle. Acceleration, particularly to usual speeds, is much better than with gear transmission. The car coasts freely downhill.

ITEMS

WHERE corn is not a dependable silage crop, it has been found desirable to use sunflowers in its place, and so successful has experimentation along these lines been that it is now advocated that sunflowers be grown in crop rotation schemes. A mixed silage of corn and sunflowers makes a more palatable and nutritious silage than sunflowers alone, and this has caused the planting of the two together. With the effective feature that sunflowers are very good in controlling weeds, the plant is slowly becoming an agricultural necessity.

THE severe nausea which is the lot of most patients after major operations may be due to chemical changes in the blood, according to K. Reuterskiold and Dr. Edmund Andrews, of the University of Illinois Medical School. These investigators have analyzed the blood from a number of such patients and have found striking changes in the proportions of calcium and potassium in the blood. They hope to prove that these changes are the primary cause of the sickness that follows operations for no other changes sufficient to cause illness were found.

A STEADY improvement in American cows, measured in terms of increased production, has taken place during the last eight years, members of the American Dairy Science Association were told. The production of the average cow has increased 1,333 pounds of milk and 48 pounds butterfat, Joseph B. Parker, dairy husbandman of the U. S. Department of Agriculture, declared. The average cow is now producing 4,500 pounds of milk. Examination of more than 100,000 yearly records showed that in any breed the larger cow is the better producer.

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SCIENCE NEWS

Scienee Service, Washington, D. C.

ACTIVITY OF THE VOLCANO MAYON

MAYON, the volcano that has destroyed the coast town of Libog and several neighboring villages in the Philippines, has aroused itself after a slumber of twenty-eight years. The eruption has not come as a surprise to students of volcanoes, because although quiescent, it was known to be active. During the nineteenth century 26 eruptions occurred, with especially violent ones in 1814 and 1897.

The Philippines boast a dozen volcanoes that are classified as active, but eruptions of most of them are rare. Mayon, and its neighbor, Taal, both of which are in south Luzon, are the most energetic, though no severe eruption of Taal has happened since 1754.

When Mayon erupted in 1897, the circumstances must have been very similar to the present one. That of 1928 began on June 21, while the one in 1897 started without warning on June 23. By the next day it began to excite alarm, and on the day after that began its work of destruction. Lava flowed down the side and for seven miles to the east; volcanic ash was rained over the surrounding country for 100 miles to the east and 75 miles to the west. Finally, by June 30 the volcano was again quiet. The next eruption was in 1900, and since then it has been inactive. Even the fiery glow which its vapors gave forth at night for centuries has been absent in recent years, but volcanologists have learned by experience that such a thing can occur without indicating that the volcano has retired for good.

Mayon forms a picture of a typical volcano. It is nearly 8,000 feet high and rises from the plain to form a perfect cone. The circumference of its base is about 120 miles.

Altogether there are sixty-six active volcanoes scattered about on the earth's surface. Their eruptions are quite independent of each other, in the opinion of volcano experts, and all are intermittent in their action.

When Krakatoa, near Java, erupted in 1883, it did so after two centuries of dormancy. One famous Japanese volcano, Bandaisan, which went off with particularly great force in 1888, was quiet for over a thousand years, so it seems that volcanoes erupting after long inactivity are apt to be unusually severe.

As a contrast to these volcanoes there stands Stromboli, in the Mediterranean, known to mariners as the "light house." For two thousand years it has been continuously, though moderately, active.

THE ADVANCE OF SANITARY SCIENCE

THE decade since the world war has allowed an evaluation of the health aspects of that conflict. The war provided a great triumph for sanitary and medical science. Whatever its political and historical significance, its chief significance to sanitarians and medical men is that for the first time in the history of the world, the number of wounded in a war exceeded the number attacked by disease. The great epidemics, amounting to plagues, of typhoid fever, smallpox, venereal diseases and dysentery and related diseases that have followed every other war, causing enormous mortality in troops and civilian population, were conspicuously absent after this last war.

The great advances in medical science during the last 30 years are credited by Dr. R. C. Williams, of the U. S. Public Health Service, with this accomplishment. Vaccination for smallpox, protective inoculation for typhoid fever, purification of water supplies and preservation of foods, vitamins and other dietary factors, prophylaxis and improved methods of treatment of venereal diseases, were able to keep the incidence of these diseases down to a minimum.

The one appearance of conditions amounting to plague—the epidemic of typhus fever and the famine in Russia and parts of Poland—was in a region where ignorance and the political situation made impossible the practice of medical science or any other science.

The only other epidemic comparable to the plagues of old was the outbreak of influenza toward the close of the war and just after. The enormous spread of this disease was due to the suddenness and unexpectedness of its onset, together with the fact that scientists knew very little about it or how it was transmitted. In spite of this, the few uninfected areas in which strict quarantine could at once be instituted escaped with relatively few cases.

An example of this is Australia, where the disease was successfully kept out for the first eight or nine months of the world-wide epidemic. Undoubtedly the insular position of the country helped here, for influenza is known to have followed lines of travel, appearing at its worst where there was great movement of civilian population and troops, such as around training camps in Europe, America and some parts of Asia.

THE FISH TAPEWORM

IN 1897 Dr. Alfred S. Warthin, professor of pathology and director of pathologic laboratories at the University of Michigan, prophesied that the fish tapeworm would be present habitually in Michigan, just as the fish themselves were in Michigan's lakes. Recent reports show that that prophecy has come true to-day.

Dr. Warthin based his prediction, back in 1897, on the fact that the large numbers of Finns who were coming to the upper peninsula of Michigan were infested with these tapeworms, which they had acquired by eating infested fish that were raw or not properly cooked.

Before 1895 there had apparently been no fish tapeworm in the state. The Finns were suspected of bringing it with them from the Baltic, for at first none of the fish in the Michigan region were infested. But

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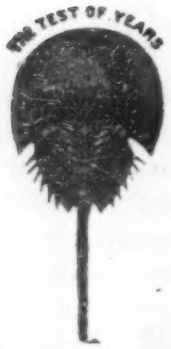

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A Suggestion

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when the second generation born here of Scandinavian parents began to be infested also, it was apparent that the fish of the region were becoming infested through the sewage. Now infestation has progressed to the point where persons in the southern part of the state, of non-Finnish descent, are also becoming infested from eating the fish of the upper lake region.

In very nearly all of the cases the patients had eaten raw or insufficiently cooked fish. So the warning has again been issued from health authorities to eat no fish that is not thoroughly cooked.

THE ORIGIN OF DIAMONDS

How does Nature make her diamonds? The fascination of the glittering jewel is heightened by the mystery of its origin. It remains a mystery, in spite of many attempts to solve it. Diamonds are known to be a form of carbon. Graphite, another form of carbon, may be produced from diamonds, but the reverse has never been accomplished.

The most famous attempt to make diamonds artificially was that of Professor Henri Moissan. He melted pure iron with sugar charcoal in an arc furnace, then plunged the molten mass into cold water. The pressure produced by the quick chilling of the outer crust was supposed to convert the carbon so that it would crystallize from the iron solution as diamond and not graphite. After treatment with various acids so as to remove all other minerals, Moissan obtained tiny crystals which had the optical properties of diamonds. Sir Charles Parsons, the English scientist, has since repeated the experiments, but he concluded that Moissan's theories were erroneous and that the crystals were due to impurities in the iron.

Many other methods have been tried from time to time. Rifle bullets have been fired into cavities which they fitted closely. Rapid compression and heating of acetylene has been tried. In every case the results have been negative, and the diamond mystery to-day remains unsolved.

A NATURAL ROCK FLOWER

A NEW "glass flower," the work of nature and not of man, has been acquired by the Harvard Museum. Visitors this summer will have their attention drawn from the world-famous Ware collection of glass flowers to a spectacular group of gypsum crystals in an adjoining hall.

Six huge crystals, the largest as long and as heavy as a man, will be displayed in a central position in the mineralogical room. This group was taken from a mine in Chihuahua, Mexico, last summer. With great difficulty, the heavy, soft, fragile crystals, as perfect in form as they are huge in size, were brought to the surface from a depth of 800 feet.

Few minerals are more easily scratched and broken than gypsum; few places are less suited for delicate work than an ill-lighted mine tunnel; nor was the operation facilitated by the desire of the native miners to be photographed while seated upon the largest and finest of the group! These obstacles were overcome by the patience and skill of the museum representatives, and the crystals have been reassembled in Cambridge in as nearly as possible their natural arrangement. Six massive spikes, radiating from a common center, show clearly why the natives called this group a "petrified century plant." Gypsum is, however, an entirely inorganic substance. Underground waters, charged with salts, built up these huge crystals. Gypsum is a fairly common mineral, but such a group as this is probably without a duplicate in the world.

EXPLORATION OF MONGOLIA

THE footsteps of Marco Polo will be followed by Professor George B. Cressey, Shanghai College geologist, who has just passed through Hankow, China, en route to Kansu and Inner Mongolia where he will study the ancient past of those remote districts of China.

New evidence of the origin of man may be unearthed by Professor Cressey in his studies although his principal studies will be upon the climate of Asia during the past ten millions of years.

Whether the people of the overcrowded plains of China will be able to emigrate to the great expanses of empty land in Mongolia, as some writers have urged, may be determined by agricultural studies to be made by Professor Cressey.

The area to be explored lies in western Inner Mongolia, north of the Great Wall from Kansu. Except for irrigated strips along the Yellow River all of this region is a desert. In the center of the area lie the great Alashan range of mountains which rise to over 10,000 feet and divide the desert into two distinct regions; the Alashan desert on the west and the Ordos on the east. The Ordos includes the district within the great northward bend of the Yellow River ouside the Great Wall.

Although an ancient Mongolian trade route crosses this district, it has seldom been followed by foreigners. Except for the few trails most of the Ordos and Alashan is quite unknown, both geographically and geologically. Marco Polo crossed the area on his journey to China, and during much of the summer the expedition will be following in his footsteps. The Chinese city of Ninghsia and the Mongol trade center of Wang Yeh Fu will be the headquarters for work.

"During the Glacial Period in Europe and North America, Asia was free from ice," Professor Cressey explained. "Mongolia, furthermore, apparently had a much more moist climate. This problem is of more than theoretical interest, for climate controls vegetation and thus influences animal life. Since Asia seems to have been the center of human evolution, climate throws light on the habitability of this area. The record of climate is written in sediments and erosion cycles, and the preliminary studies made in 1924 indicate that this area contains critical information. While no direct search is to be made for ancient man, it is important to note that the best evidence of early man so far found in central Asia is on the borders of the Ordos near Ninghsia.

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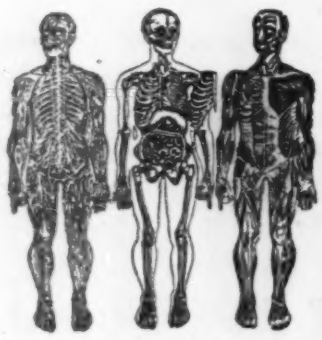

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"Geologically the map is white, and large areas are geographically unknown as well. Prejevalsky and Obruchev, two Russians, visited the region sixty years ago, and most of our knowledge dates back to them."

Professor Cressey has over 2,000 miles of travel in Inner and Outer Mongolia to his credit. Both the Ordos and the Alashan were visited in 1924 on the return from an expedition to Koko Nor in Tibet. There was no opportunity for detailed studies at that time, but hasty examination indicated several promising areas. Since that time the few available reports of earlier explorers have been examined and definite projects mapped out.

An attempt to continue work in 1926 resulted in an attack by brigands, before the area was reached. Mongolia itself is characteristically peaceful, but the Chinese borderlands are often in an unsettled condition. Reports indicate that conditions along the route which it is now proposed to follow are quiet.

This is the land of wandering nomads who pasture their flocks of sheep and camels on the sparse desert grass. The rainfall is less than ten inches, and wells are few and far between. It is often necessary to carry water. Camels are commonly used, but they travel at night and only ten miles a day; for the most part the expedition will use pack mules.

LIFE HISTORY OF THE EEL

EELS, the "snaky fish" of yesterday's crossword puzzle fame, are the inspiration and objective of a two-years' scientific cruise in the Pacific on which Professor Johannes Schmidt, of the University of Copenhagen, has just embarked. He will endeavor to solve the riddle of the spawning grounds and migration routes of the Pacific eels as he did for the Atlantic species of these highly valuable fish.

The story of the eel, as so far unfolded, is one of the most interesting and even romantic of all scientific sagas. Eels have been favorite fishes in Europe since remote antiquity, and their ways while in fresh water were fairly well known, though always puzzling. Young eels were never seen to descend a river, and old eels never went any other way. No one had ever seen an eel's egg. The young ones came up from the sea, the old ones went to sea; but what happened in the sea was an unsolved mystery for centuries. The most fantastic stories imaginable were told of the eel's origin: they were said to arise from everything between spontaneous generation in the mud and parenthood directly from Jupiter himself.

Professor Schmidt set himself to solve the riddle, and for seventeen years he labored on it. At the end he knew the whole story. Eels come up out of the sea, as young "elvers," persistently ascending the rivers. They live and feed in fresh water for several years. When full grown they go down to the sea, and swim across the whole width of the North Atlantic to an area northeast and east of the West Indies. Here they lay and fertilize their eggs and then die.

The young eel larvae do not resemble eels in the least. They are leaf-shaped, flat, thin and as transparent as glass. They feed on minute water organisms, and slowly make the long voyage homeward. How they find their way without guides (since their parents are all dead) is still a mystery. And the strangest part of the story is that though American and European eels breed in the same general region of the ocean, their respective young always find their ways back to the proper sides of the Atlantic.

It takes three years, more or less, for the young eels to get back from their deep ocean cradle to the offshore waters of home. Nearing the close of their voyage, they change their shapes from the flat, leaf-like form to the familiar round, thin figures of the elvers, and then go up the streams to begin their parents' life-story over again.

All this Professor Schmidt discovered by patient study in field and laboratory and endless sailing on the North Atlantic. Now he is undertaking to learn what he can of the ways of the eels that live in the rivers that flow into the great ocean on the other side of the world.

ITEMS

THE region of Fort Humphrey, Virginia, will echo to the explosions of radium atomite, new explosive claimed to be more powerful than T. N. T., sometime in August. According to the office of the chief engineers of the War Department, Major William H. Lanagan, of the board of engineer equipment, has requested such a demonstration. A preliminary test of the explosive invented by Capt. H. R. Zimmer, of Los Angeles, former army officer, was made at Pasadena by Lt.-Col. L. M. Adams, of the California Institute of Technology. Lt.-Col. Adams reported to the chief of engineers, and the board, after examining his report, has decided that the new explosive "appears to have military value."

ARE you the stuff that civilizations are made of? Pioneer minds of civilization—the type of men who bridge the gap between old established customs and a new, higher type of culture—are being sought for study by two graduate students of the University of Chicago, H. M. Bond and H. P. Becker. The minds of such men are signposts, showing the way in which our civilization is headed, according to Professor Robert Park, of the university, whose theories of sociology will direct the study. Professor Park terms such men "marginal men." As migrations bring groups of people into new environment, the "marginal men" strive to live in two diverse cultural groups, and they free themselves from the old ways to make a better adjustment to life. The conflicting cultures meet and fuse in these "marginal men," and it is in the minds of this type that the process of civilization is visibly going on and may best be studied.

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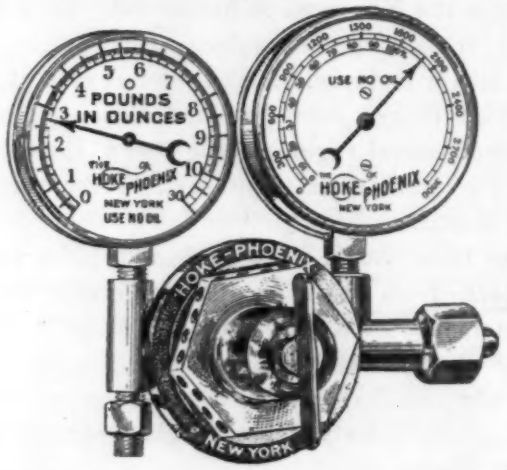

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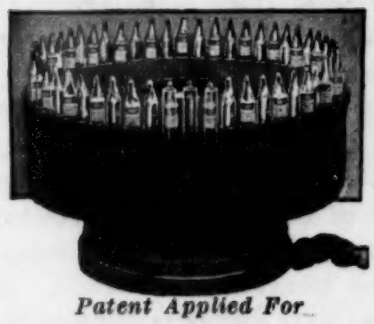

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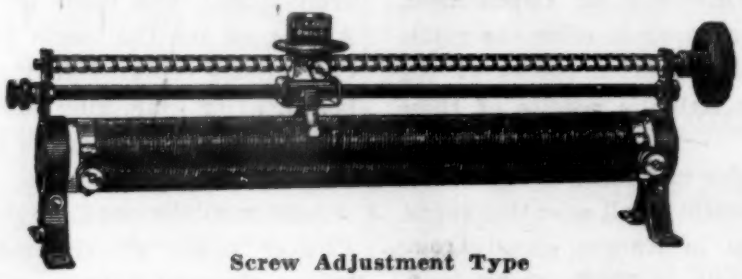

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SCIENCE NEWS

Science Service, Washington, D. C.

RADIO RECEPTION AND NORTHERN LIGHTS

WHEN your radio crackles, squeals, moans or stubbornly remains silent despite your coaxing, does the earth's magnetism have anything to do with such antics? That is what scientists of the Coast and Geodetic Survey have been trying to find out. F. P. Ulrich, magnetic observer of the survey, stationed at Sitka, Alaska, summarizes the results of five years' observations by saying in a recent report: "In general, the condition of the earth's magnetic field is no index of the quality of radio reception." Thus the fact seems to be established that the earth's baffling magnetic forces are not to blame when your radio goes on a temperamental rampage.

Mr. Ulrich observed that the aurora borealis, or northern light, which is a manifestation of the earth's magnetism, occurs in greatest brilliancy on magnetically disturbed days. The aurora causes difficulties in cable transmission, he says, but "observations seem to indicate that good radio reception is very much more apt to occur than poor reception during a bright or faint aurora." That absolves the aurora, magnetism's magnificent advertisement, from suspicion of being the monkey wrench in radio's machinery.

In an effort to unravel the greatest of all scientific mysteries—the earth's magnetism—scientists have been making methodical, monotonous, deadly dull routine observations for years. They record the daily and hourly variations in the earth's magnetic forces at widely scattered observatories from Samoa to Honolulu and Alaska. An effort is also made to connect these records with other phenomena such as earthquakes, sun-spots, and the aurora, and with radio reception and telegraphic and cable disturbances. It is hoped in this way to ferret out nature's most profound secret—the secret of those magnetic forces which, up to now, have defied scientific analysis.

A NEW SUN-SPOT

A LARGE spot on the sun, some 30,000 miles long, was on line with the earth on July 7 when brilliant displays of northern lights were seen, and a still larger one was at the center about July 12. It was close to the center of the sun as seen from the earth, even closer than the one apparently associated with the recent aurora displays. Possibly more magnetic disturbances, like those which tied up telegraph lines, and still more intense northern light displays, may have come at that time. Astronomers point out, however, that the connection between the aurora borealis and the sun-spots is still a mystery, and so the new spot may fail to produce results.

Experiments made by Dr. Carl Stormer, a Norwegian scientist, indicate that the auroral displays are similar to the effects that occur inside a vacuum-tube when a high voltage electric current is passed through it. Cathode rays are formed which act on the minute amounts of gas remaining in the tube, and cause it to glow. Sun-spots are huge cathode ray tubes, giving off these rays at all times. When a spot is in the center of the sun as seen from the earth, that is, when it faces the earth, the rays are aimed at us. They are bent by magnets, and so the magnetic poles of the earth draw them in. As they reach the rarefied gases in the earth's upper atmosphere, they are made to glow as in the vacuum-tube.

In laboratory experiments Dr. Stormer aimed cathode rays at a magnetized sphere in an evacuated chamber, and miniature streamers similar to those of the northern lights were produced.

ARCTIC MUMMIES IN NATIONAL MUSEUM COLLECTION

THREE mummies from the Arctic caves of the Aleutian Islands, similar to those just discovered by the Stoll-McCracken Expedition, have been in the possession of the U. S. National Museum for more than 50 years, according to a statement by Dr. Aleš Hrdlička, anthropologist of the museum.

The museum had a number of these strange mummies that date back to about the seventeenth century, before the white man penetrated the Arctic. For a time some of them were on display. But they are rather gruesome exhibits and they had a somewhat morbid fascination for the public, so they were finally macerated and the skeletons were measured and examined to add to the government scientists' knowledge of ancient man in America.

The three mummies that have been preserved intact in their burial robes and wrappings are those of an adult, a child of about ten years and a young infant.

A careful study of the Arctic burials was made by Dr. William H. Dall, of the Smithsonian Institution, in the 1870's. The islanders were loath to talk about the ways of their ancestors. But Dr. Dall wandered through the maze of rocks and caverns, and discovered a number of the mummy caves. The bodies were wrapped in skins and grass mats and hidden in the caves, partly because the islands afford few good places for interment, and partly because the caves offer the best protection against the chill fog and dampness of the region. Secrecy was important, because the body of a famous whaler of the tribe, or even the possession of a whaler, would bring skill in whaling to any one who posssessed them. To foil robbers, and to keep the skill of the dead hunter in his family, the dead man was entombed as cautiously as possible.

A rarer type of mummy than those wrapped in skins and mats has been seen in the islands by explorers, but no specimens have ever been brought away. These mummies are not encased, but have been placed in the caves in positions resembling life. Dead men clad in wooden armor, it is said, stiffly grip their spears as they wait to

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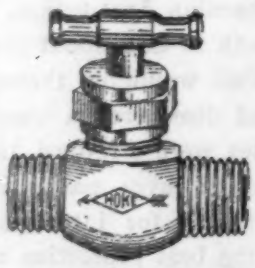

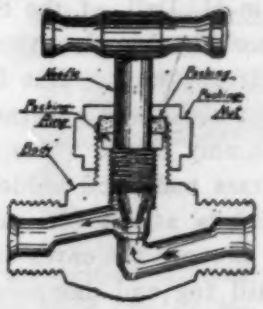

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DISCOVERY OF PTEROSAUR BONES

A FOSSILIZED wing-bone of a pterosaur, recently sent from Oregon to the U. S. National Museum for examination, has given the first indication of how these great flying lizards of dinosaur days lightened their bones to combine a maximum of strength with a minimum of ballast. Birds, the most successful of modern flying vertebrates, have thin-walled, hollow bones with air spaces inside, on the plan of the tubular metal braces and struts of the larger airplanes. The pterosaurs, this specimen shows, had not evolved so highly perfected a device. Their bones were not completely hollow, but the cavity was filled with a very light, spongy webwork of bony tissue, which served as cross-braces to strengthen them.

All bones of flying lizards hitherto found have been crushed flat, Dr. J. W. Gidley, paleontologist of the Museum, explained. This gives the present specimen unique interest and importance. A further note of interest is found in the fact that this pterosaur comes from Oregon, and represents the farthest west of all flying reptile finds to date.

The find consists of a single bone, the humerus or upper arm-bone. It is about eight inches long and one and one half inches in diameter at its ends. At the slenderest part of the middle of the shaft it is three quarters of an inch in diameter.

The upper arm-bone accounted for a relatively small part of the wing-span in the flying reptiles. The forearm-bone was somewhat elongated, and what corresponded to the finger-bones of one of the fingers were greatly exaggerated. Only one of the fingers supported the wing; the others were short and apparently of use in clinging or climbing.

THE YELLOWSTONE CANYON

A NEW history of the Grand Canyon of the Yellowstone will need to be written as a result of geological research by members of the Princeton Summer School of Geology and Natural Resources who have just completed an investigation of the canyon and the area bordering this great natural ditch.

When the first transcontinental expedition of Princeton geologists, traveling in the special geological Pullman "Princeton," as well as students, visited Yellowstone Park in 1926 they obtained the first hints that the origin and history of the canyon needed reexamination and possible revision. This year the area was restudied by the geologists under the leadership of Professor R. M. Field, director of the expedition, and Professor O. T. Jones, of the University of Manchester, England, one of the foreign guests.

During the Tertiary period, the age of mammals, some tens of millions of years ago, the geologists concluded, a canyon of nearly the present dimensions was excavated. This great waterworn depression was later blocked by volcanic lavas near its lower end and filled to the brim with sediments. The present canyon from the upper falls of the Yellowstone to the lower end was largely reexcavated only a few millions of years ago. The digging of the new canyon by the river's water has taken place since the great Glacial epoch, when ice covered much of America.

"One of the most striking conclusions resulting from this discovery," Professor Field declared recently, "is the fact that the lower fall of the Yellowstone has occupied its present position since the later Tertiary period when the first excavation of the canyon was made."

Professors Field and Jones will publish further details of their discoveries in the fall after the return of the expedition which is now enroute to the Pacific coast. The new information obtained suggests to these experts that the stratigraphy and petrography of this frequently visited region needs revision upon the maps and in the geological records.

NEW STYLE CABBAGES

FARMERS who have been working for years to produce bigger and fatter cabbages are now anxiously hunting for smaller and slenderer varieties. Old style eight-pound cabbage heads rot in the markets, because the modern housewife can no longer be induced to haul home enough cabbage to last her family a week, according to Dr. C. H. Myers, of Cornell University, who is working on this serious farmers' problem.

New style cabbage varieties must weigh only about two or three pounds, because small families, storing their food in apartment house kitchens, live rather literally from hand to mouth. Through experiments with smaller varieties, now in progress, Dr. Myers hopes to show how farmers can get a higher yield to the acre, so that they will not lose money by raising smaller and cheaper heads.

Several years ago, Dr. Myers proudly displayed a nicely formed little cabbage head that he had produced on the experiment farm. All the farmers who saw it shook their heads and said it might be a promising variety, but it was much too small to be practical. Now the good points of this scorned cabbage head are being reconsidered.

One of the newest varieties produced in the cabbage-breeding experiments is a real red-head cabbage. This magenta-colored vegetable is far redder than the purplish variety ordinarily known as red cabbage, Dr. Myers says. Another new type is a cabbage with grayish purple leaves. These varieties are being studied partly to trace the inheritance of the purple sun color in the outer leaves of this strain of cabbage. The experiments have an immediate practical value, however, since home economic experts approve highly of the gay tinted cabbage leaves for making attractive salads.

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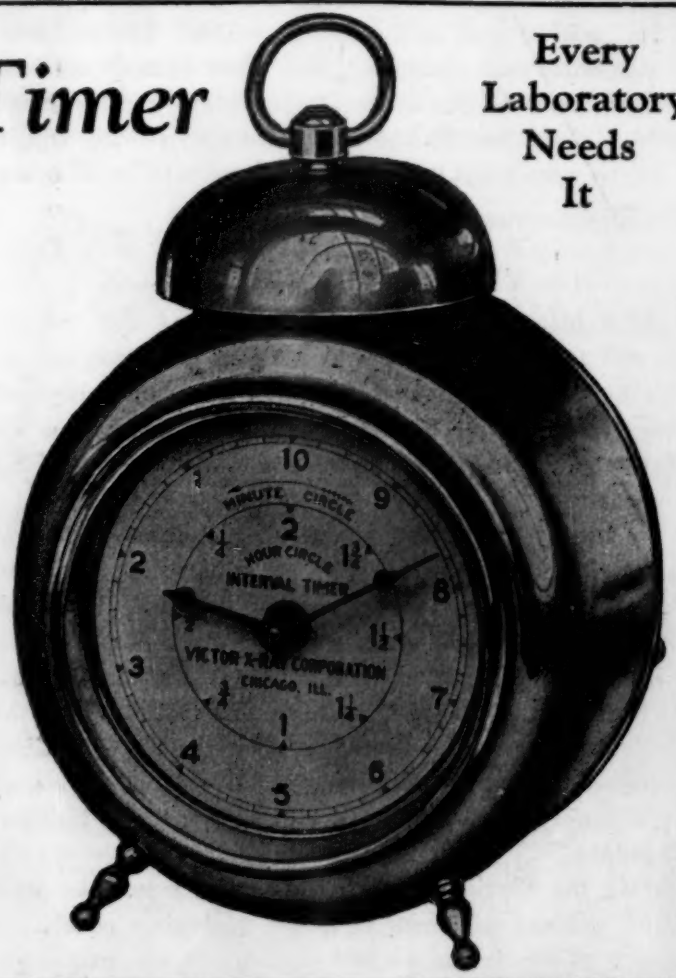

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touching land. This large cruising radius will be needed, for in the voyage to the region between Greenland and Labrador, the birthplace of the icebergs, she will travel more than 3,000 miles before returning to Sydney, the northernmost point where supplies are available. The *Marion* is equipped with two Diesel engines, and is 125 feet long. Though small in size, she is unusually seaworthy.

The crew will consist of twenty Coast Guard sailors, specially selected from a large number of volunteers. With their two officers, Lieutenant-Commander Edward H. Smith and Lieutenant N. G. Ricketts, they will make up the personnel of the expedition. But they will not confine their attention to icebergs, for there are numerous other problems that demand solution, particularly those concerned with the ocean currents in this little-known region.

The Hydrographic Office of the U. S. Navy will also gain valuable information as the result of the expedition. Hundreds of soundings will be made in 50,000 square miles where no depth measurements have previously been made. The *Marion* will also visit villages along the Greenland and Labrador coasts, and their facilities and other pertinent maritime information will be recorded for the benefit of the Hydrographic Office.

Observations of weather conditions, such as data on storm tracks, and percentages of fog for both Greenland and Labrador, will be made for the U. S. Weather Bureau. Since this region is part of the shortest air line route between the United States and western Europe, and may in the future be important in transatlantic aviation, these observations may be of untold value.

Radio amateurs in the United States will be the means by which the expedition will keep in touch with civilization. A short-wave radio set is provided on the ship, which can communicate with the United States. The American Radio Relay League has requested that amateur operators listen carefully, in order that messages from the *Marion* in the far North may be picked up.

ITEMS

Two earthquakes in the Pacific Ocean within six hours, one of which caused severe shaking in southern Alaska, and the other in the Fiji Islands, was the record established on Thursday, June 21. Earthquake experts of the U. S. Coast and Geodetic Survey at Washington located the positions of the quakes by means of data sent to Science Service. The first one, at 5 hours 40.4 minutes a. m., Eastern standard time, was centered at latitude 18 degrees south and longitude 179 degrees west. The position is among the Fiji Islands. The second quake happened at 11 hours 26.7 minutes a. m. It was centered at latitude 60.5 degrees north and longitude 152 degrees west. This is about the position of Cook Inlet, Alaska, and not far from Seward.

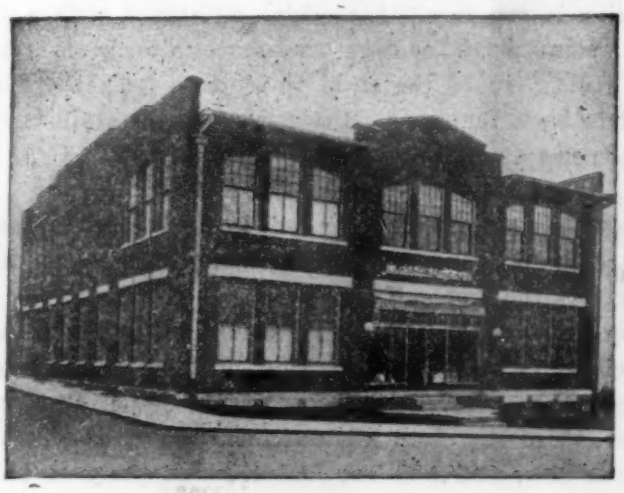
Methods of removing the brown stain that often disfigures Indiana limestone used for building facing and trim were announced to the American Society for Testing Materials at Atlantic City by Lee Huber, research engineer, of Bedford, Ind. A jet of steam played on the stain followed by bathing with 5 per cent. formic acid solution is one cure. A poultice moistened with a 5 per cent. solution of sodium carbonate also gives results. Mr. Huber traced the stain to seepage from the cement used to back the stone. Prevention of the stain is aided by the use of white portland cements.

Floods recently experienced in Oklahoma, Missouri, Kansas and Arkansas can be blamed more on after-effects of the floods of last year than to abnormally high water at present. According to Dr. H. C. Frankenfield, in charge of the flood section of the U. S. Weather Bureau, the break of a levee on the upper St. Francis River, in southeastern Missouri, was due to the fact that it was new, and had not had time properly to harden. The older levees in this region were destroyed last year. Had this break not occurred, and flooded the near-by region, the water might have continued down stream, and produced heavier floods below, he stated. At present, the flood on the Arkansas River is not great, but it is considerable on the White and Black rivers.

The increasing use of antitoxins and inoculations against specific diseases is presenting a new problem to scientists. To diagnose a number of diseases, agglutinization tests are now made on the patient's blood serum. However, agglutinization may also occur as a result of previous immunization against certain diseases, for example, typhoid fever. A new serum that distinguishes between agglutinization due to an infection and that due to immunity, has been perfected in the case of undulant fever (abortion disease in cattle) by I. Forest Huddleston, of the department of bacteriology at the Michigan State College.

The vanilla flavoring in ice cream survives the freezing, P. S. Lucas, of Michigan State College, reported to the American Dairy Science Association meeting in Madison, Wis. The flavor does not freeze out when the cream hardens, neither does it lose intensity with age. Eight kinds of vanilla flavoring were tried in identical ice cream mixtures and samples were tested regularly for 214 days. The long storing had no effect on the flavor. Souring or the use of the homogenizer by the dairyman formerly were considered the cause of cream curdling, or feathering, when poured into hot coffee. But experiments at the University of Illinois have shown that this condition is due to the presence of calcium salts in the cream.

A new find of three skeletons of the famous Cro-Magnon race of stone age times is reported from the Vallee du Roc, Charente, in France. The remains were those of a man about fifty years old, of a woman and of a youth just cutting his first wisdom tooth. They had apparently all been buried in a cave, the roof of which later fell, covering their graves still more deeply with rough blocks of stone. This rock fall had considerably damaged the skeletons.



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Those authors who have read proofs will know the correctness of the composition, including the technical scientific terminology. A distinguished scientific man wrote recently to the editor of "Science": "I corrected my first proof a year before you were born and the one I returned yesterday was the first one in my long experience that needed no correction."

The press prints "The Scientific Monthly," "Science," "School and Society," "The American Naturalist" and some twenty other scientific journals and publications. The typography and press-work of these journals will bear comparison with any weekly or monthly publication, although, for example, "Science" must be printed mostly in one day in an edition of over 13,000. The new edition of "The Biographical Directory of American Men of Science" is an example of the work of the press. It can to special advantage print scientific monographs and doctorate dissertations.

Correspondence should be addressed to the secretary, Jaques Cattell, The Science Press Printing Company, Lancaster, Pa.

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SCIENCE NEWS

Science Service, Washington, D. C.

A GRAND CANYON OBSERVATORY

WITH the cooperation of French glass manufacturers, a huge observatory, dwarfing all present institutions, is planned for the best location in the vicinity of the Grand Canyon of the Colorado in Arizona. This announcement was made on July 18 to Science Service by Professor George W. Ritchey, famous American astronomer who has been working in Paris for the last five years.

Professor Ritchey first came to Paris in connection with the plans of a wealthy Hindu, the late Assan Dina, to build an observatory on Mont Saleve, in the French Alps, at a cost of $6,250,000. He had built the 60-inch reflector of the Mt. Wilson Observatory as well as the optical parts of the 100-inch reflector, still the world's largest telescope, so he was placed in charge of the research to develop methods of building still larger instruments.

About two years ago, Dina withdrew his support after the expenditure of about $40,000, but Professor Ritchey has continued his work at the Paris Observatory, with the aid of M. Delloye, head of the St. Gobain glass works, where the glass for most of the world's biggest telescopes has been made. The present plans include a great observatory at the Grand Canyon, Arizona, which Professor Ritchey believes to be one of the best astronomical sites in the world. The telescope is intended to be of a new type, in which a pair of mirrors reflect the star's light down to a huge concave mirror. There will be several of these mirrors, with different magnifying powers, and they can be changed at a moment's notice, to take advantage of short changes in atmospheric conditions. The mirrors will not be of solid glass, but built up in a fashion somewhat resembling a honeycomb, by a method that Professor Ritchey has developed. The curves to which they are ground will also be new, having been worked out by Professor Ritchey in conjunction with Professor Henri Chretien, a French astronomer. Tests of mirrors made according to these curves have demonstrated their superiority.

When asked what effect Dina's recent death would have on his plans, Professor Ritchey stated that he knew nothing of the future of the Dina project and that his own work was entirely independent. He has received no word from Mme. Dina, who, according to one report, expects to return to her late husband's original ideas and build the observatory on Mont Saleve.

FARM RELIEF AND THE CHEMIST

How the farmer can help the chemist by supplying him with cheaper material, and how the chemist at the same time can help the farmer by providing a new and profitable outlet for some of his materials that are now wasted, will be one of the subjects discussed at Northwestern University during the coming weeks. On July 23 the opening session was held at the university of the American Chemical Society Institute, which will continue for a month. Chemists from all parts of the United States, and leaders in their profession from numerous foreign countries will attend and tell of the latest accomplishments of chemical science.

The first week will be devoted to the general topic of agriculture, for the chemist believes that in his hands, and not those of the politician, lies real farm relief. Representatives of the U. S. Department of Agriculture, agricultural school officials, and other experts, will show how the farmer need no longer depend entirely upon the use of his products for food.

Catalysis and hydrogenation, two subjects which sound technical but which are really of vital importance to everybody, will be among the principal topics of the second week. "A catalyst," explained Dr. Frank C. Whitmore, director of the institute, "is simply some material which makes a process which we desire to go on take place more rapidly than it otherwise would. If it is really true that time is money, then a catalyst is one of the best forms of money, since it saves time. Hydrogenation means the changing of oils like peanut oil and cotton seed oil, which are not edible in their ordinary form, into solid fats resembling lard which can be used for a great variety of purposes. Those fats which are inedible are used for soap making."

The institute's third week, he stated, will include such subjects as petroleum, the preparation of the artificial resins and lacquers that now find a wide variety of uses under such trade names as bakelite and duco, chemistry and health and chemistry and life processes. During the fourth and concluding week problems of sanitation will be discussed from a chemical viewpoint. Other programs will be on meat packing, leather and ceramics, including the making of such useful products as electric light bulbs. Chemistry in warfare will be considered on the last day, but the meeting will close with a lecture on "Chemistry and Peace."

MOLDS IN THE MANUFACTURE OF ACIDS

How a common black mold, known as a spoiler of food, has been drafted for the manufacture of citric acid, long a monopoly of lemons and other sour citrus fruits, was told by H. T. Herrick, of the U. S. Department of Agriculture, speaking before the American Chemical Society Institute, at Evanston, Ill.

At least as far back as Noah's famous spree, Mr. Herrick reminded his audience, man has used fungi for the production of desired chemicals; for the yeasts that ferment sugar to alcohol are fungi. The molds, belonging to a different fungus family, have also served mankind in the making of such things as cheese, for the green streaks in prime Parmesan are really moldy spots. But it is only lately that molds have been deliberately set to work on sugar, and their possibilities as chemical servants are only beginning to be realized.

THE JOURNAL OF GENERAL PHYSIOLOGY

EDITED BY

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CONTENTS OF VOLUME XI, NO. 6, JULY 20, 1928:

SCHREINEMAKERS, F. A. H. Osmosis of liquids. General considerations.

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YEAGER, J. FRANKLIN. Hemolysis by saponin and sodium taurocholate, with special reference to the series of Ryvosh.

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The book has been revised in the light of helpful criticisms from teachers who have used it since it was published six years ago. Much new matter has been introduced, chiefly in the fields of vitamins, hormones, determination of sex, and heredity. Two chapters have also been added on the classification of animals and plants. Numerous omissions and changes have been made in order to simplify certain difficult topics.

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Duke University

In this revision of *General Zoology,* several chapters have been completely rewritten, five new chapters dealing with histology, embryology, physiology, ecology and genetics have been added, minor changes have been made throughout the book, and a number of new illustrations have been included. The new material not only brings the book up to date but also adds to its usefulness as a text in general zoology. The illustrations and the simplicity of presentation are especially commendable. $2.75

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The principal industrial exploitation of the appetite of a mold for sugar at present is the manufacture of citric acid. This has received a special stimulus from the imposition of an export tax by Italy on its citrate product, derived at present wholly from lemon culls. Since the whole soft-drink industry depends on citric acid, and a great deal is used in flavoring extracts as well, the Italian export duty may have almost the same effect on the infant American acid-from-mold industry as a protective tariff.

At present the sugar from which the mold makes citric acid is the familiar cane sugar or sucrose. This is relatively expensive, and Mr. Herrick and his assistant, O. E. May, are now at work in the hope of producing citric acid from the action of mold on the cheaper corn sugar or glucose. Hitherto this has not been possible because of the impurities present in commercial glucose, but a product of high purity is now available.

Citric is not the only acid that can be produced by the action of molds on sugar. There are many different kinds of mold, and many varieties of sugar, and the combinations possible are almost infinite, according to Mr. Herrick. Such acids as oxalic, malic, lactic and succinic are now known to be produced by molds, and the investigation has not proceeded very far.

One acid, which has hitherto been so rare that it is listed at over $100 a pound, has been produced by Mr. Herrick and Mr. May in the government laboratories at about thirty-five cents a pound. This is gluconic acid, which is the result of the action of one species of mold on glucose. Very little is known of what gluconic acid may be good for, because its high price has hitherto practically prohibited experiments, but an investigation of its industrial possibilities may now be expected.

VITAMIN REQUIREMENTS OF INSECTS

WHILE new facts about the vitamins necessary for the health and happiness of the human race come to light nearly every day, entomologists have been endeavoring to find which, if any, vitamins are needed to keep up the health and morale of the insect world.

The subject of the investigation into insect vitamin lore selected by Dr. Charles H. Richardson, of the U. S. Bureau of Entomology, was the Mediterranean flour moth, a well-known pest of the flour mills that passes most of its existence gorging on flour. Since the wheat kernel from which flour is made is an important source of vitamins A and B it was thought that this would be a good type of insect with which to obtain a quantitative check-up on the proportion of vitamins necessary for insect welfare.

In whole wheat flour the larvae of the moths lived and flourished happily but in the same kind of flour from which a substance believed to be vitamin A was extracted by chloroform, relatively few larvae developed into full-grown moths. In highly milled flour, from which much of the growth-promoting vitamin B is removed by the processes of manufacture, the growth rate was also poor. With the addition, however, of small quantities of yeast, a rich source of vitamin B, the number of larvae that reached maturity increased.

According to these results obtained by Dr. Richardson, the reaction of the flour moth toward vitamins A and B checks very well with the requirements of laboratory animals and human beings. Further studies on this problem with other insects will be of great interest from the point of view of comparison of insect physiology with that of higher animals. Practically it will affect the control of insect pests since any factor that might render poisoned bait for harmful insects more attractive would assume great economic importance.

YELLOW FEVER IN BRAZIL

QUARANTINE officers in all ports south of Norfolk, Va., have just been instructed by the chief of the quarantine division of the U. S. Public Health Service to be on the alert for cases of yellow fever. An epidemic of this disease is under way in Brazil, where 87 cases and 29 deaths have been reported, according to figures received by the U. S. Public Health Service.

Of these, all the deaths and 79 cases are from Rio de Janeiro. Probably many more have occurred but have not been reported. Those that have been reported are all from seaports; conditions in the interior are still unknown.

The danger of yellow fever breaking out in the United States when there is an epidemic in Central or South America is always acute. The yellow fever mosquito, *Aedes egypti*, is still plentiful in the southern part of this country and just one bite of a yellow fever patient is all the mosquito needs to start an epidemic of the disease here.

Contrary to popular belief, yellow fever has not been eradicated. Although it has been kept out of the United States and Europe, it is still a very great menace. Two main centers of the disease exist; one is in Africa, where Noguchi and two associates recently died of the disease in the course of their investigations on it, and the other is in South America. A flare-up from either center is always possible, just as cholera and plague frequently spread to epidemic proportions from their centers in India.

Recent investigations point to a reservoir of yellow fewer in certain monkeys of Africa, and public health officials believe that a similar animal or mosquito or even human reservoir exists in South America. These reservoirs consist of subjects that have been infected and recovered, but that are capable of transmitting the disease to others.

THE EUROPEAN CORN BORER

THE European corn borer, which has become a scourge in America, is being guarded against in the Union of South Africa with all the vigilance that would be used to stop the coming of the black plague or an invading army. It has not yet succeeded in gaining a foothold in South Africa, and government scientists do not propose that it shall do so.

NEW SCIENTIFIC BOOKS

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ELEMENTS OF ASTRONOMY. Edward A. Fath. pp. x + 323. 212 figures. $3.00.

Second edition, revised to include recent findings. A new set of star charts is given. The book is a non-mathematical text-book for use as an introduction to the subject in colleges and universities and for the general reader.

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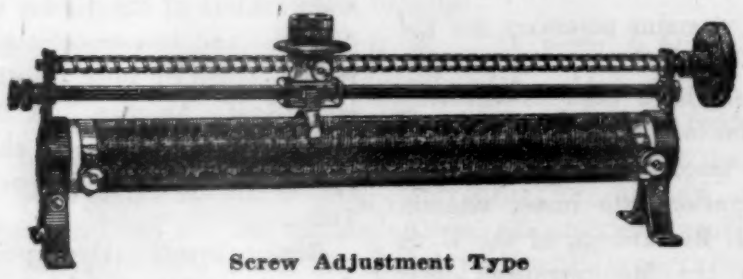

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One bad alarm occurred in Johannesburg over a year ago, and entomologists are still watching the neighborhood of the threatened outbreak. In South Africa, as everywhere else, housewives need brooms, and broom factories exist to supply the demand. Broom-corn has to be imported from Europe and South America, because the locally raised crop is not sufficient. Inspections of baled European broom-corn have shown the presence of the borers in the stalks, just as they were in the stalks of European broom-corn imported into Canada and the United States some years ago, from which the present plague got its start.

In the yard of a Johannesburg broom factory a few chance stalks of broom-corn sprang up from stray seeds, and these were found to be infested with young borers. They were promptly obliterated, and every kitchen garden for blocks around was inspected by entomologists. So far as known at present, not a single borer escaped the search, but the watch will have to be kept up for several years to make sure that the clean-up was complete.

In the meantime, the Union has passed stringent inspection regulations for imported broom-corn. None may be brought in unless it has been freed of all stalks large enough to harbor a borer. In the factories the bales are stored in mothproof rooms kept rigidly under lock and key, and the few workmen who have access to them are put through the same elaborate ritual on leaving as employes of a mint.

South Africa already has one pest in its cornfields, which it considers more than sufficient. This is the stalk borer, a creature related to the European corn borer and having many of the same habits. Recommendations to the South African farmer for its control are reminiscent of those now being published in the American corn belt for the control of the European corn borer.

BURIAL CUSTOMS OF ANCIENT SWEDES

Graves fifteen centuries old recently unearthed at Tuna, in central Sweden, have shed a new light on the elaborate and loving care which ancient Swedes lavished upon their dead. The burial mounds, according to Dr. T. J. Arne, a government archeologist, are the richest and most remarkable found in Sweden for many years.

In one of the graves the skeleton of a man lay in the remains of a boat which was to carry him on his last long journey. Like the other graves, it was placed in true east to west direction, and the traveler had been well provided for. His horse, fully harnessed, and his dog had been placed in the stern of the ship and he had been given plenty of food for his journey. A round bronze buckle, evidently serving to fasten his mantle around his shoulders, was also found as well as several iron arrow heads, which showed he had been well armed. To keep his weapons sharp, he had a small whetstone fastened in a ring. A number of well-preserved earthenware pots were also discovered in the grave.

The next burial place contained a similar boat, in which a man and his wife had started their last journey together, each of them having a horse and a dog. The man had his sword and shield, and the woman had iron cooking implements and knives to enable her to prepare their food, and also a number of little female trinkets, including two combs of bone.

Under another mound the remains of a man was discovered, but he had been buried without a boat. By the side of the deceased lay a mighty iron sword, a dagger, a knife, a flint and tinder for making fire, a beautiful sword belt of bronze and gold, richly ornamented, and a large silver buckle, inlaid with garnets set in gold. All these articles were in a decorative design of striking character and probably were of southern Germanic origin.

ITEMS

Of course, everybody drinks more water during very hot weather, but if just a pinch of salt is added, it will help greatly toward enduring the heat. Scientists investigating conditions in hot coal mines and steel plants found that the workers who succumbed rapidly when working in a temperature of about 100 degrees, were able to stand it better when this small amount of salt was added to their drinking water. At high temperatures, especially when working hard, the body gives off large amounts of water in perspiration. This is nature's way of keeping us cool. But our bodies also lose much salt with the perspiration which is what causes a large part of the physical exhaustion felt when working in hot weather. To overcome this, add a pinch of salt to your drinking water.

The feeling that English sparrows are disappearing in this country is without justification, according to the U. S. Bureau of Biological Survey. While there has been a decrease of these birds in the last few years, so that they are no longer the pest they were 40 or 50 years after their first importation, nature seems to be setting a balance in regard to them. In the West and Middle West they are still apparently on the increase. American songbirds are in no danger of extinction, like their relatives among the game birds. For the most part they are not in a precarious position, officials of the bureau report.

The story popular in the tropics that the barracuda is very dangerous and will attack humans while in bathing has just been acclaimed by scientists as no fish story but actual fact. The barracuda, of all marine fish, is most dangerous to man, Dr. E. W. Gudger, of the American Museum of Natural History, and C. M. Breder, Jr., of the New York Aquarium, have just reported to the American Medical Association. For the first time, one of the many reported cases of barracuda bite was subjected to scientific study. A sailor, bitten while swimming in the Caribbean off the shore of Panama, was taken to the Colon Hospital for treatment at the time that Mr. Breder was also a patient there. Mr. Breder was able to recognize the wound definitely as that of a barracuda bite.

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SCIENCE NEWS

Science Service, Washington, D. C.

NATURAL COLOR MOVIES

NATURAL color movies that every one can make and project had their scientific début on July 30 at the home of George Eastman, photographic pioneer and head of the Eastman Kodak Company, Rochester.

Through the utilization of thousands of miniature lenses, invisible to the naked eye, but impressed into the photographic film itself, these new colored motion pictures will come into the American parlor before they are shown in magnificent movie palaces.

By slipping a special color filter into the ordinary amateur movie camera and using the special film, the amateur can take the new color motion pictures. In development the film is changed to a positive but, due to the principle of the process, the film is just black and white, with no color or dyes appearing in the film itself. The process is a result of several years' development by the Eastman Kodak Research Laboratories under the direction of Dr. C. E. K. Mees.

It is a short span of years since the day in 1888 when Eastman introduced the first roll film kodak with the slogan: "You press the button and we'll do the rest." But to-day the achievement of the recreation of a real scene with a camera that any one can operate is nearly complete. Movies brought motion, the development announced recently brings color. Only the addition of sound to the home movie outfit is left for the future.

A remarkable group of inventors, scientists and public men witnessed the first announced demonstration of the amateur natural color movies.

Thomas A. Edison, whose motion pictures have now been made colorful, was a witness. Frederick E. Ives, inventor of the half-tone process, the fundamental principle of which is used in the new color movies, was also present, as was his son, Dr. H. E. Ives, of Bell Telephone Laboratories, who steered the development of telephoned photographs and television demonstrated within the last two years. Dr. Leo H. Baekeland, inventor of Velox photographic paper, as well as the synthetic resin bakelite, was also a guest. Other scientists present were: Dr. E. F. W. Alexanderson, television inventor, and Dr. W. D. Coolidge, inventor of X-ray and cathode-ray tubes that bear his name; Dr. Michael I. Pupin, the physicist who made long-distance telephony possible; Hiram Percy Maxim, inventor; Dr. G. K. Burgess, director of the U. S. Bureau of Standards; Sir James Irvine, Scottish chemist, and Dr. Henry Fairfield Osborn, of the American Museum of Natural History. The following public leaders were also guests: General John J. Pershing; Owen D. Young, General Electric Company head; Major-General James G. Harbord, president of the Radio Corporation; Dr. John J. Tigert, U. S. Commissioner of Education; Frank David Boynton, Ithaca superintendent of schools; Karl A. Bickel, president of the United Press Association; Kent Cooper, general manager of the Associated Press; Roy Howard, of the Scripps-Howard Newspapers; Adolph S. Ochs, publisher of the New York *Times;* David Lawrence, publisher of the *U. S. Daily,* and Dr. Edwin E. Slosson, director of Science Service.

QUARTZ AND EARTHQUAKES

CROSSING earthquakes with quartz pebbles to raise a number of speculations about the inside of the earth is the feat performed by Professor R. A. Daly, of Harvard University. Linking the fact that the common substance, quartz, changes its physical properties when heated with other seemingly totally foreign facts about earthquake waves, Professor Daly has discovered relationships that may lead to our finding out the real nature of the foundations of our continent.

Quartz is a material found nearly everywhere on the surface of the earth. As white pebbles on beaches, crystals in cavities, or sand grains in sandstone, it is known to many. No one knows, however, if quartz is as abundant inside the earth as it is on the surface. Indeed, it may not exist there at all, at depths of many miles.

Neither mines nor oil-wells can tell us much about the deep insides of the earth. Professor Daly's information is based on the study of earthquakes. Earthquake shocks send out earth-waves which are received on seismographs all over the globe. It is known that the deeper these waves penetrate the faster they travel. But the increase of speed is not uniform. On the contrary, there are two sharp jumps, at depths estimated by European computers to be about twenty and forty miles below the surface.

Returning to the subject of quartz, Professor Daly points out that its physical properties change when it is heated. Again, this change is not uniform. There is a sharp jump at a certain temperature. Vibrations would spread more rapidly in quartz above this temperature than in quartz below this temperature. The earth gets hotter as we burrow down into it. At a depth of twenty miles it may well be hot enough to change low-quartz into high-quartz, and this change would readily explain the change in speed of the earthquake waves. As for the second jump in speed, the discontinuity at forty miles, Professor Daly suggests that below this depth there may be no quartz in the rocks at all. In a recent number of the *American Journal of Science,* Professor Daly has elaborated his views and has brought many lines of scientific thought to a focus on that unknown territory, the inside of the earth.

THE CABBAGE PLANT AND TEMPERATURE

A CABBAGE plant that produced six cabbage heads in turn, one above the other, and has finally ended its career with a crop of viable seed at the top of the eight-foot "stalk" is an unusual occurrence that is likely to go down in botanical history.

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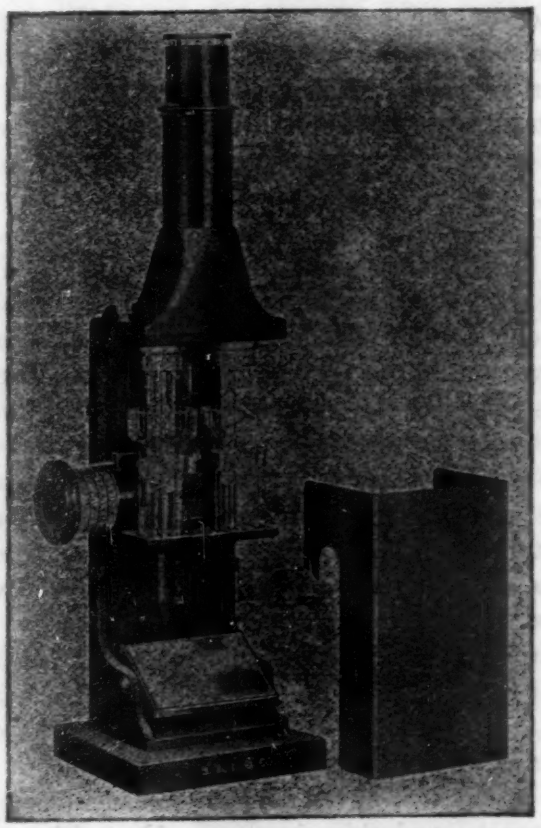

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over two years, according to Julian C. Miller, of Cornell University, who conducted the experiment. Seeds were produced only when the plant was removed last November to a cooler greenhouse where the temperature averaged from fifty-five degrees to sixty degrees Fahrenheit.

This cabbage is one product of a series of experiments that show that controlled temperature has an important effect on crops such as cabbage or beets that normally require two years to complete the cycle of fruit and seed. Vegetative growth continues so long as the plant is kept at the higher temperature, Mr. Miller has found. Seeds are not produced until the temperature is lowered, bringing about the necessary changes within the plant.

Ordinarily, farmers and seed-growers put cabbage plants in storage through the winter and set them out the second spring to produce seed. Recent experiments at Cornell show that the cabbage plant requires only a two-months' rest period in storage at thirty-five degrees to forty degrees Fahrenheit, after which the plants can be transplanted to a greenhouse for seed production. In this manner the two-year cycle can be compressed into one year. This method is particularly desirable for growing the first and second generation seed of any cross or selection.

Experiments on annual plants by W. W. Garner and H. A. Allard, of the U. S. Department of Agriculture, proved the importance of length of day in the maturing of annual crops. In the case of the cabbage, Mr. Miller has found that increasing the amount of light had no effect, but temperature appears to be a controlling factor of great importance.

THE BIOLOGICAL EFFECTS OF RED AND YELLOW RAYS

THE red and yellow light rays of long wave-lengths are just as important as the shorter violet or ultra-violet rays for normal growth and development, according to Dr. Charles Sheard, of the Mayo Clinic.

Dr. Sheard and associates experimented with chickens, exposing different groups of them to sunlight from which the ultra-violet, red-yellow and green-blue rays, respectively, had been removed by special glass filters. At the same time, all the chickens were fed a diet rich in everything except vitamin D.

When either the red-yellow or the green-blue light was filtered out, the parathyroid glands, which play an important part in the process by which food is transposed into tissue and energy, increased greatly in size in order to maintain normal growth and development.

During the first two months the rate of growth of the chicks was greater under all filters when a small amount of cod-liver oil was added to the diet. At the end of six months' time it was found that the weights of chicks under both the amber and blue filters was much less than under the whole of sunlight except in the cases where cod-liver oil was fed. This small amount of cod-liver oil is apparently able to induce normal growth and development irrespective of the presence or absence of any portion of either ultra-violet or visible solar energy.

Without cod-liver oil and on a standard ration, experiments showed that normal growth did not take place unless both the ultra-violet and visible rays of sunlight were admitted.

MEMORY FROM INFANCY

AN adult who relates strange things that happened to him in the first year, or even the first days, of his life may be remembering the actual facts, in the opinion of J. A. Hadfield, psychologist at London University.

People who apparently recall events out of a supposedly blank babyhood are noted from time to time by psychoanalysts, as they probe into the early years of life in search of the root causes of maladjustments. Such stories have often been taken with a grain of salt by the individual's family, who believe that these must be merely imaginative memories that have come to seem real to the individual. It is also possible that the individual's "memory" of an event was gained in perhaps his third or fourth year of age, from hearing some one else recount an incident of his babyhood.

Describing a number of cases in the British medical journal, *Lancet*, Mr. Hadfield tells of a doctor who remembered a fire that occurred when he was eight months old. The fire completely destroyed the house and no pictures of the home were preserved. The doctor described the circular staircase and a colored glass window at the landing, and the flames licking at the glass panels. When he was about seven years old, he had told his parents about this memory, and gave so many details that they accepted the story, incredible as it seemed to them.

A more remarkable instance cited by Mr. Hadfield is that of a woman under hypnosis who vividly described the terrifying infantile experience of being slapped, held upside down and shaken harshly. The psychologist inquired if she did not know how they revived infants when they do not breathe after birth. She answered that she had no idea, and was surprised to hear that she had described the usual procedure.

Undoubtedly young children are too young to understand the whole significance of their experiences, Mr. Hadfield comments. But they "are not too young to feel, and experiences that are not in the least understood by a child may produce violent commotion in its soul."

Studies of anatomy, he states, show that in the year-old child the brain center for emotion is active, though the center for more discriminative thought is probably not in full function.

The young child, he suggests, can hold in its memory the feeling of a scene, and later when he can use language, he puts the feeling into words more or less accurately as the case may be.

LARCH CANKER IN THE UNITED STATES

AMERICA'S dwindling timber supply is threatened by a new tree disease, similar to chestnut blight, which is capable of wiping out stands valued at approximately $3,150,000,000, says Dr. Haven Metcalf, in charge of

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the Office of Forest Pathology, U. S. Department of Agriculture.

Larch canker, as the disease is called, has been known in Europe for about a century and is believed to have been brought here on seedlings from Great Britain, prior to enactment of the plant quarantine law. It was recently discovered attacking trees in two New England states.

Dr. Metcalf characterizes the disease as "far and away the most potentially serious tree disease that has ever struck the United States." Its danger, he explains, lies not in the fact that it is attacking and killing the native larch, or tamarack, a tree not commercially important, but that it has proved contagious to the Douglas fir and the yellow pine, the two most important timber species in North America.

Drastic measures will be necessary to stamp out the disease before it gets beyond control and, in Dr. Metcalf's opinion, it may be too late now. Three thousand diseased trees in Massachusetts and Rhode Island will be burned out this summer. It is not known whether other areas have been affected, but larch canker is equipped to spread rapidly.

Fear is expressed that the great Douglas fir forests of the West may become infected because the larch forest, ranging in a continuous broad belt from New England to the Pacific coast, interlaces with the fir forest near British Columbia, forming a bridge upon which the disease could cross. Little is known about the disease, but imported diseases and imported pests, it is stated, are frequently far more virulent in countries they adopt than in their native habitat.

THE EAGLES AT VERMILION, OHIO

A DUAL tragedy at the aerie of the pair of American eagles which have nested for many years three miles east of Vermilion, Ohio, probably will make this season the last for the observations of Dr. Francis H. Herrick, of Western Reserve University, and C. H. Shipman, a naturalist, of Willoughby, Ohio.

Dr. Herrick and his associate have been studying the great American bird at first hand for several weeks each summer for the past seven years. They have a specially built 125-foot steel observation tower overlooking the aerie. Here they have spent the greater part of each day during the nesting season.

Early this season they reported the disappearance of the male eagle. Since the eagle mates for life and has never been known to desert its mate, it is probable that the bird was either killed or driven away in a territorial warfare. Both the naturalists and residents of the town are greatly interested in finding out its fate. As a result of this misfortune the two baby eaglets hatched this season were somewhat neglected during their infancy because of the mother bird's tendency to do only her own share of the work of rearing her family. The smaller eaglet, through lack of food and abuse from its brother, died several weeks ago. From that time on the mother cared assiduously for the remaining baby until early this week, when it was large enough to leave the aerie and look out for itself.

ITEMS

VINEGAR made by the old-fashioned fermentation process is far superior to synthetic acetic acid, German scientists have found. While all vinegars vary greatly in their vitamin content, the synthetic variety is lacking in vitamin D, the important food factor that prevents rickets in children, report Dr. A. Janke and H. Lacroix.

CHINESE boys and girls of Kwangtung ancestry living in Hawaii grow faster and more regularly than boys and girls of the same age living in China, investigations made by Vivia B. Appleton have shown. This is credited to the better living conditions in Hawaii, which present an environment more favorable to normal growth. Chinese children living there grow more like European children. Those measured were between 6 and 20 years. The differences between the sexes is more marked among this group than among those studied in China. Racial differences between the two groups were present before adolescence but were more decided after.

THE northern coast of Peru, near the scene of a severe earthquake on May 14, was again shaken on July 18. Seismic waves from the center of the disturbance, relayed to Science Service from eight seismograph observatories, permitted the experts of the U. S. Coast and Geodetic Survey to locate it at seven degrees south latitude and 79.7 degrees west longitude. It happened at 2:05 eastern standard time. The observatories reporting the disturbance were located at Manila, P. I.; Sitka, Alaska; Honolulu, T. H.; Tucson, Arizona, and Chicago, Ill.; all of which are operated by the Coast and Geodetic Survey, and at Georgetown University, Washington; St. Louis University, St. Louis, and the Dominion Observatory, Ottawa, Canada.

THE division of anthropology and psychology of the National Research Council is turning a searchlight on the problems of the deaf and hard of hearing, to determine the most practical methods of rendering aid. Ten subcommittees have been appointed, composed of specialists in medical, psychological and educational aspects of deafness, Dr. Knight Dunlap, chairman of the division, has announced. One subcommittee, headed by Dr. F. Lyman Wells, of Boston, will report on the emotional and social difficulties among the deaf and hard of hearing. Another of the ten subcommittees will suggest what most needs to be done in teaching those with defective hearing. After the subcommittees have worked out a practicable program of research, the problems involved in carrying out the needed work will be considered. But until a sane, comprehensive and practical research program has been developed, the attempt to finance or initiate research would be unwise, and probably unfortunate, Dr. Dunlap stated.

NEW SCIENTIFIC BOOKS

The Macmillan Company, New York

INFANCY AND HUMAN GROWTH. Arnold Gesell. pp. xvii + 418. $3.50.

This is a companion volume to the author's earlier volume, "The Mental Growth of the Pre-school Child." It deals with early human growth at close range, by methods of systematic observation and of direct record.

THE FROG. Waldo Shumway. pp. viii + 67. $0.90.

A laboratory guide in which is given an account of the anatomy, histology and embryology of the frog. The book differs from the usual "problem" type of manual in that it tells the student exactly what he is to find in the specimen he is dissecting.

ORGANIC CHEMISTRY. James Bryant Conant. pp. ix + 291. $2.60.

A beginning text for a year course or, with certain omissions, for a one-semester course. The author has tried to make the subject attractive to the student. There are diagrams of important industrial processes and special laboratory set-ups.

VESTIGES OF PRE-METRIC WEIGHTS AND MEASURES. Arthur E. Kennelly. pp. xi + 189. $2.50.

The author spent a year in a number of European countries for the purpose of finding how numerous or important the vestiges of old units might be in commerce. The results of the research tend to show the length of time it takes a country to bring the metric system into general use.

Longmans, Green & Company, New York

MEASUREMENT AND CALCULATION. Norman R. Campbell. pp. ix + 293. $5.00.

This book, intended primarily for advanced students, expounds the principles underlying the making and the use of measurements of all kinds. The matters discussed are closely related to the actual practice of physics and will also be of interest to the laboratory worker.

Paul B. Hoeber, Incorporated, New York

RENÉ THÉOPHILE HYACINTHE LAENNEC. Gerald B. Webb. pp. xix + 146. 13 plates. $2.00.

A sketch of the life of the famous French physician, with details in regard to his invention of the stethoscope.

Yale University Press, New Haven, Connecticut

HISTORY OF THE SHEFFIELD SCIENTIFIC SCHOOL OF YALE UNIVERSITY. Russell H. Chittenden. In two volumes. 610 pp. Illustrated. $10.00.

An account of the founding and development of Yale's Scientific School. The time covered is from 1846, when the United States was just beginning to realize the importance of scientific research, to the year 1922.

D. Van Nostrand Company, New York

FIXATION OF ATMOSPHERIC NITROGEN. Frank A. Ernst. pp. ix + 154. $2.50.

Intended for those who are unfamiliar with the subject and who want general information in regard to it.

The Cambridge University Press, the Macmillan Company, New York

BIOLOGICAL CHEMISTRY AND PHYSICS OF SEA WATER. H. W. Harvey. pp. x + 194. $4.25.

A discussion of the chemistry of sea water, water movements, temperature of the sea, color and illumination of sea water and the chemical and physical factors controlling the density of population in the oceans.

ASTRONOMY AND COSMOGONY. J. H. Jeans. pp. x + 420. $10.00.

A description of the present position of cosmogony and of various closely associated problems of astronomy, as, for instance, the physical state of astronomical matter, the structure of the stars and their ages. The language is as simple as scientific accuracy permits.

CILIARY MOVEMENT. J. Gray. pp. viii + 162. 105 figures. $4.25.

An account of ciliary mechanism in the invertebrates and very small animals, from a physiological point of view.

THE NEW QUANTUM MECHANICS. G. Birtwistle. pp. xiii + 290. $5.50.

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Write for Bulletin 273

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SCIENCE NEWS

Science Service, Washington, D. C.

THE PERSEID SHOWER OF METEORS

WATCH the northeastern sky Saturday night, August 11, and even into the early morning hours of Sunday. Then you will be rewarded by a sight of some of the meteors, or "shooting stars," of the famous Perseid shower.

But though it is called a "shower" one should not expect anything approaching a shower of rain. True, there have been showers of meteors in the past, when the entire sky has been covered with thousands of them, like the ribs of a gigantic umbrella. Such a shower is very rare, and no one can tell when one will again occur.

On almost any clear night a careful watcher can probably see half a dozen meteors flash across the sky in the course of an hour. At the time of the Perseids, however, this number may greatly increase, so that one can easily see an average of one a minute or even more. This month they will be easily visible because the moon will be out of the way, and Saturday night will be dark. When there is a full moon in the sky at the time of the shower, its brilliance, while not making the meteors completely invisible, at least makes them less conspicuous.

The name of the Perseid shower comes from the location of what astronomers call the radiant. That is, the ordinary casual meteors that one sees on any night may float across the sky in any direction. The meteors of a shower, however, all seem to radiate from a particular part of the sky. In the case of the August shower, the radiant, or point from which they seem to come, is in the constellation of Perseus, which can be seen high in the northeastern sky after midnight.

Actually, the meteors are not coming from a point. They are moving in parallel paths. In the distance these paths seem to come together, in the same way that the tracks of a railroad seem to come to a point in the distance, even though they are actually the same distance apart at all places.

These meteors travel around the sun in a huge swarm. Probably all parts of this path along which they travel are densely populated with them, but some parts more than others. In August, the earth, in its own travels around the sun, crosses the path of the meteors. Then they fall into the earth's atmosphere, but the friction generated by the friction with the air soon burns them up in a flash of light that we may see. When the earth happens to cross the meteoric orbit at the same time as one of the very dense accumulations, they are unusually numerous, and a shower such as that of some past years is the result.

One thing about the study of meteors that makes it of interest is that it is one of the few branches of astronomy in which serious study can be made without the aid of a telescope. Under the guidance of Professor Charles P. Olivier, of the Flower Observatory, of the University of Pennsylvania, at Philadelphia, hundreds of these amateur astronomers report regularly on the meteors they observe. They are gathered together into an organization called the American Meteor Society. As there are many parts of the country where none of their members are located, Professor Olivier is anxious to receive more reports from these volunteer observers.

SPECTRUM OF THE NORTHERN LIGHTS

PHOTOGRAPHS made at the Lowell Observatory of the spectrum of the Northern Lights at the time of the brilliant display on July 7 has opened up a new scientific mystery. For the first time, there appears, in addition to the various lines due to known elements, a very prominent line in the red region of the spectrum. As it has never before been photographed, Dr. V. M. Slipher, director of the observatory, who recorded it, is unable to state definitely what elements cause the reddish color. However, he suspects that it is due to some known gas in the atmosphere of the earth, possibly nitrogen.

On the photographs taken by Dr. Slipher there also appeared very prominently the so-called green auroral line, which was long a mystery. First photographed during visible displays of the northern lights, or aurora borealis, it was found at the Lowell Observatory in 1915 that it could be recorded by pointing a spectrographic camera at any part of the sky on any night even if cloudy. Dr. Slipher has also made such photographs of it on numerous occasions and under all sorts of sky conditions, always with success. He finds an unaccountable variation of its intensity shown even in a few minutes. This may occur during a night that remains constantly clear, so is not due to the weather conditions.

However, the origin of the green line was shown a few years ago by Professor J. C. McLennan, of the University of Toronto, and Professor G. M. Shrum, of the University of British Columbia. Studies made in his laboratory with the aid of low temperatures obtained with liquid air and liquid hydrogen, finally demonstrated that it was due to familiar oxygen.

ANCIENT HUMAN REMAINS IN NEW MEXICO

RELICS of a buffalo hunt held by primitive men near Folsom, New Mexico, thousands of years before white men came to America continue to puzzle and attract scientists. In response to a telegram from Folsom received by the Smithsonian Institution, reporting new discoveries of stone arrow-points and fossil bison bones, Neil Judd, a Smithsonian anthropologist, has set out for the scene of the excavations to examine the remarkable evidence. The excavations are being conducted by the Colorado Museum of Natural History and the American Museum of Natural History.

The stone arrow-heads used in the hunt have been found close to bones of bison supposed to have become extinct in America long before men appeared on this continent. If the stone weapons were shot at this liv-

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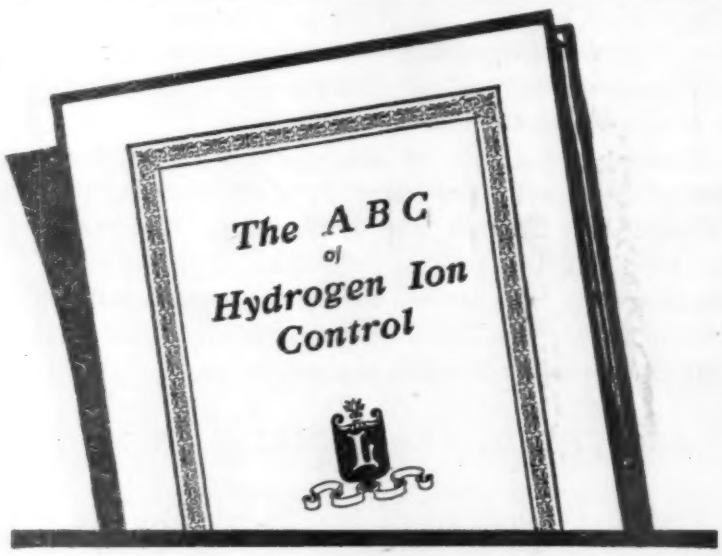

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ing game, as the evidence indicates, the conclusion of some scientists is that men must have inhabited America at least 25,000 years, possibly even several hundred thousand years. No evidence has ever been discovered in this country to show that the types of bison found with the arrow-points have lived in America in recent times.

Dr. Oliver P. Hay, of the Smithsonian Institution, is now engaged in studying some of the bones of these extinct bison. The bones found at Folsom belong to bison with flattened horns different from any living form, Dr. Hay states.

Additional clues to the age of the bones and the weapons are the depth and formation of the earth in which they lie and the layers of soil that have accumulated above them in the progress of time.

A CORN BORER PARASITE

(Science Service Correspondent)

A NEAR relative of the silkworm disease which caused the famous Pasteur much grief, but also brought him much fame, is being studied in France as a possible ally in the war against the corn borer.

It is known that insects suffer from a multitude of diseases, many of which are epidemic and destroy large numbers, but the practical applications of insect pathology present an almost unexplored area of science. Insect diseases, like those of man, are usually caused by microbes such as bacteria, fungi, or the ultramicroscopic group of viruses.

Dr. A. Paillot, in a paper presented at a recent meeting of the French Academy of Science, reported the discovery of two new protozoa or single-celled animals which are parasites of the European corn borer in certain parts of France. One is a flagellate and propels itself forward and backward with a nearly ultramicroscopic whip-like appendage. It is quite rare and is found occasionally in the internal organs of the corn borer larva.

A more promising disease is a microsporidia to which Dr. Paillot proposes to give the name *Perezia pyrausta*. It spreads decidedly in an epidemic fashion, and has been observed frequently in two regions of the Jura. Dr. Paillot says that externally the sick corn borer larvae do not differ from the healthy larvae, but that internally they are pretty badly wrecked. The disease is transmittable from individual to individual through the intestinal tract.

THE CHEMIST AND THE FOOD SUPPLY

THE specter of starvation pressing on an overpopulated world is something the chemist refuses to worry about. Economists and sociologists have concerned themselves over the population problem ever since Malthus worked out a statistical expression of it over a century ago, but they always assume unchanging needs and tastes on the part of the population, and unchanging methods for the production of food.

At the meeting of the Institute of Chemistry of the American Chemical Society, Dr. H. E. Barnard, of Indianapolis, challenged these assumptions, and declared that the chemist will be able to meet the food problems of any imaginable future population. The only thing that can limit the race is sheer lack of standing-room, he said.

"The sociologist and economist study the Malthusian doctrine very differently from the chemist," Dr. Barnard continued. "They would limit world population to the number of people who can live happily and comfortably under the best living conditions to-day. The chemist is not so much interested in ideal living conditions as in applying scientific law to do the work of the world, no matter whether it is concerned with shelter or food or comfort.

"The chemist is impatient when he hears the Malthusian doctrine discussed in terms of wheat acreage, or sugars, or fats, for he is confident that when the fertile acres of the earth do not produce crops sufficient for man's needs he can synthesize them in his laboratory. Indeed he is already doing it. When the need comes the chemist will convert the light of the sun and the nitrogen of the air into food for the human family. Thirty men working in a factory the size of a city block can produce in the form of yeast as much food as 1,000 men tilling 57,000 acres under ordinary agricultural conditions. To the chemist the Malthusian doctrine is but the sad reflection of a pessimistic world."

THE USE OF FURFURAL

FURFURAL may well become the chemical word familiar to every household of the coming generation, as coal-tar is to those of the present. This is the prophecy ventured by C. S. Miner, of Chicago, before the Institute of Chemistry of the American Chemical Society now in session at Evanston, Ill. And the discovery that this hitherto rare chemical can be made cheaply in commercial quantities is almost an accident, the result of experiments aimed at an entirely different objective, he said.

In the preparation of rolled oats, hundreds of tons of oat hulls are left as a by-product at the end of the milling. Little use could be found for them, and they accumulated around the mills in vast quantities. In an endeavor to render them edible, at least for cattle, they were subjected to various chemical tratments, and one of these experiments resulted in the production of furfural in appreciable amounts. Since then research has followed two lines: to produce it as economically as possible, and to find new uses for it.

Furfural is very active chemically, is a solvent of wide application, and possesses many properties tending to give it commercial value. It is at present being used very extensively in the manufacture of synthetic resins and moulding compounds. Recently a light-sensitive furfural resin has been produced which is used in the preparation of printing plates.

Because of its germicidal properties and also its fungicidal properties furfural is finding application in the preventing of fermentation in glues and dextrin pastes, as well as in the preparation of disinfectants and deodorizers. Some derivatives of furfural are being used as

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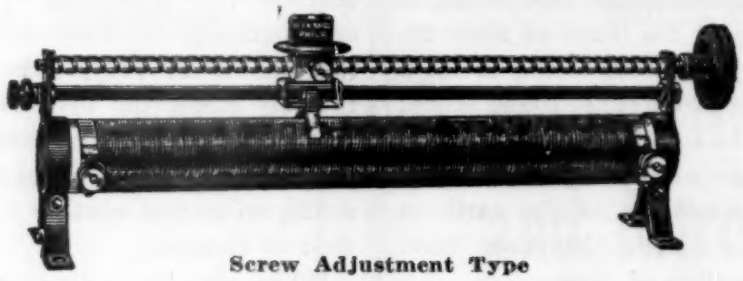

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seed disinfectants and furfural itself is used in the preparation of tree wound dressings.

"Research men are constantly working with furfural and its derivatives and undreamed of uses for them are found every day," Mr. Miner said. "The annual crops furnish an almost inexhaustible, relatively cheap supply of raw material for the production of furfural, and as it is a highly reactive compound capable of functioning as the raw material for a wide range of chemical manufacturing processes, it may well form the basis of a branch of American chemical industry comparable in importance to the coal-tar industry in Germany."

PEROXIDES

ALTHOUGH the average citizen is familiar with only one peroxide, hydrogen peroxide, which he uses for a mouth-wash and his daughter may use for a hair bleach, peroxides of various other kinds play a more important part in his daily life than is usually realized. Some of the things for which peroxides are useful were described before the Institute of Chemistry of the American Chemical Society recently by Dr. V. R. Kokatnur, of Arlington, N. J.

"Hydrogen peroxide can be described as being composed of two parts, viz., oxide head and hydrogen trunk," said Dr. Kokatnur. "If this oxide head of hydrogen peroxide is attacked to a trunk of a different genus such as one severed from organic compounds, we get an organic peroxide.

"Nature has many such organic peroxides. When a drying oil such as linseed oil, tung oil or turpentine dries in air, it forms a tough film of organic peroxides and in a sense the paint and varnish industry may be said to depend on this discovery. When a beautifully colored leaf or flower fades or changes its color in fall, it is perhaps due to a whole or part bleaching of such colors by peroxide formation.

"The oxygen of organic peroxides is of active type and is many hundred times more powerful than oxygen of hydrogen peroxide. This property makes organic peroxides extremely useful in arts and industries. Thus nearly fifty per cent. of flour consumed in the country is bleached and treated by an organic peroxide. More flour is reclaimed than would otherwise be available for human consumption by this treatment. They are increasingly being consumed in the refining and bleaching of many of our edible oils."

Dr. Kokatnur prophesied a possible important rôle for these little-known compounds in developing a future liquid fuel supply.

"There are many other outlets awaiting future exploitation but one of them provides a wonderful tool in the hands of a chemist for novel synthetic products," he said. "While they may not be cheap and commercially feasible in the immediate future the changed circumstances might make them very important. The present hectic efforts being made to replenish the gasoline supplies from other sources like coal can not really solve the problem. Even the coal supplies can not last forever and the only way to solve the problem is to fall on sources that are perennial and can be grown from the soil. Organic peroxides might then point the way to replenish the gasoline supplies from such perennial sources."

ITEMS

THE color test for vitamin A in cod-liver oil has now been proved thoroughly reliable when compared with the old, biological method of testing for presence of this vitamin, according to experiments carried on at laboratories in the University of Sheffield, University College, London, King's College for Women, London, The Lister Institute and the University of Oslo. At these laboratories several different samples of the oil were tested by the biological method, which is a feeding method carried out on experimental animals, and the same oils were tested by the color test by Dr. Otto Rosenheim, of the National Institute for Medical Research, London, who originally devised the color test. The results were so similar that the reliability of the color test was proved without any doubt. The two methods are now to be compared for other substances containing vitamin A, such as butter.

SOME physicians have for a long time been prescribing cod-liver oil to children and adults who were pale and listless, had no appetite and tired easily, who were, in reality, suffering from a low-grade anemia. Experiments carried on at the Kansas State Agricultural College have shown that the oil helped these patients by increasing the number of red cells in their blood. The experiments were made on college girls who took a teaspoonful of the oil daily. The gain in red cells after eleven weeks is reported at from 800,000 to 1,500,000. The girls all showed a corresponding improvement in physical condition.

THE difficult job of keeping contact with the white man's "farthest north" on this continent, and the scientific study of the still relatively unexplored Arctic, are the tasks faced by the Canadian Government steamer *Beothic,* which has set out from North Sydney, N. S. The first port of call will be Godhavn, Greenland, where courtesies will be exchanged with Danish officials. After that the *Beothic* will turn westward for the season's cruise among the islands off the northern coast of North America.

A FREAK stroke of lightning apparently electrocuted a large white oak tree in the New York Botanical Garden recently. The tree was struck during a thunderstorm, but was not shattered as trees frequently are by lightning. Almost immediately, however, the leaves began to wither, and within a month the tree presented an autumnal appearance against the bright green of the rest of the grove. Continued observation convinced the garden authorities that the tree was dead, and that it had apparently died instantaneously. After it was cut down a ring count gave its age at approximately 200 years.

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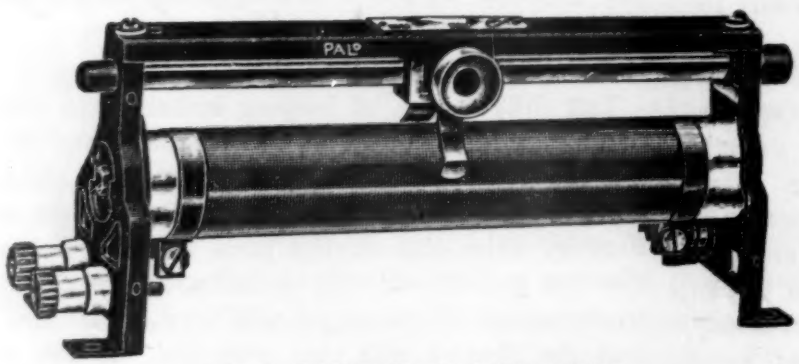

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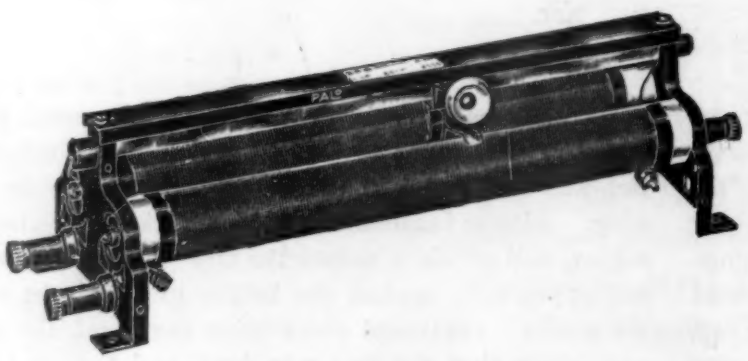

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SCIENCE NEWS

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THE FOURTH INTERNATIONAL CONGRESS OF ENTOMOLOGY

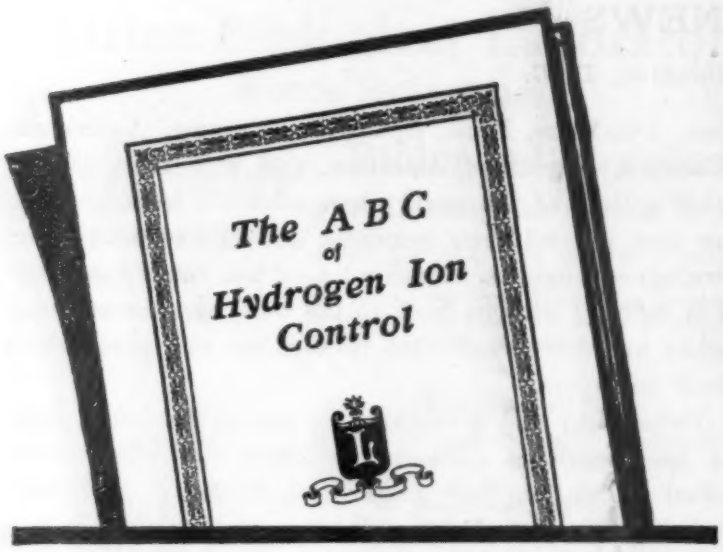
ENTOMOLOGISTS from all over the world, men who study the ways of insects in order to make war on the harmful ones and to get use out of the beneficial ones, opened the Fourth International Congress of Entomology at Cornell University on August 12. Hundreds of scientists from the United States, Canada and Mexico are meeting with the leading members of their profession from overseas countries during the coming week to exchange news and views. The present gathering is the first international congress of students of entomology to meet in the United States. The first of its kind was held in Brussels in 1910, and the second in Oxford, England, in 1912. The war, with its subsequent unsettled period, prevented another meeting until 1925, when it was held in Zurich, Switzerland. Delegates are present at Ithaca from the following countries: Argentina, Australia, Austria, Belgium, Bulgaria, Canada, Chile, China, Cuba, Czechoslovakia, Denmark, Egypt, England, Finland, France, Germany, Greece, Guatemala, Hawaii, Hungary, Italy, Ireland, Japan, Mexico, Netherlands, New Zealand, Norway, Poland, Porto Rico, Rumania, Scotland, South Africa, Spain, Sweden, the United Soviet States of Russia, the United States.

An international defensive alliance against enemies that threaten to overwhelm the human race is being discussed at Ithaca during the present week. The participants in the congress assembled there, which will break up in one week without any flourishes or signing of treaties, are not diplomats but scientists, and the enemies against which they wage warfare are not foreign soldiers. It is against insects that the members of the Fourth International Congress of Entomology will sound the alarum. It has become an axiom among scientific men that the only animal group which has not acknowledged man's overlordship, the only group which may seriously contest his place in the sun, are the six-legged little fliers and crawlers that most of us think of only as annoyances that bite our ankles, or crawl down our necks, or get into our picnic salad. Insects do much more serious things than these. They raid our crops: even to the lay world the names corn borer, army worm, Japanese beetle, Mexican bean beetle, boll weevil and a host of others sound menacingly. They attack our cattle and decimate the herds with disease; tick, botfly and tsetse all take their toll. They carry the germs of death to man himself: mosquito and fly are a deadly duumvirate, and they have a host of assistants. Not for nothing did the ancient Israelites recognize in Beelzebub, the God of Flies, the everlasting ancient enemy and destroyer. In this warfare, of which the meeting here may be likened to a conference of the general staff, there are no central powers, no allied and associated powers, no neutrals. German, Austrian, Russian, Briton, Frenchman, Italian, Czech, Slovak, Magyar, Belgian, Dutchman, Dane, Spaniard, Japanese, Australian, Canadian, Argentine, American, and men from all the other nations of the world where scientific work goes on, are here to pool their resources and exchange ideas on strategy and tactics. Mankind need not yet cry out that it is fighting with its back to the wall, and the entomologists are determined that to such an evil pass things shall not come.

Entomology and lawmaking do not at first sight seem to have much in common, yet there are insects that affect legislation very markedly. Termites, sometimes called "white ants," have caused a number of communities to modify their building codes to fit, or rather to oppose, their tastes, Dr. Thos. E. Snyder, of the Bureau of Entomology, U. S. Department of Agriculture, told the Fourth International Congress of Entomology. There are over 1,600 species of termites, and most of them live on wood. And they don't care whose wood it is or where it is. Telephone poles, railroad ties, hardwood floors, antique furniture, bookcases and the books in them—they are all just provender for termites. Therefore to keep them out special types of protected building have had to be designed, and termite-proof construction is coming to be as strictly required in some cities as fireproof building.

There are two main groups of termites that cause most of the trouble in American cities. One, which does not burrow in the ground, attacks dry wood wherever it finds it. This kind can be stopped by means of chemically treated wood; or, if already entrenched, can be killed by poison gas or by heating. Furniture can be made hot enough to kill the termites without marring its finish. The second type burrows in the ground and bores into moist wood it finds in contact with it. These insects can be effectively stopped by seeing that all building timbers are kept off the ground, on dry concrete or masonry foundations or pilings. Termite-proofing a building need not add more than two per cent. to the original cost, and often saves many times its outlay in deferring replacements which these insects would otherwise make necessary in a short time.

A poultry raiser is glad enough to see one chick or duckling hatch out of one egg. He would be astonished if one egg should suddenly provide him with a whole yardful of fowls. But that, in effect, happens in the insect world, according to Dr. R. W. Leiby, of the North Carolina Department of Agriculture, who spoke before the congress. The insect group in which this strange phenomenon occurs, Dr. Leiby explained, constitutes a winged clan friendly to man in his warfare with the creeping things that take toll of his crops and orchards. They are tiny wasp-like insects, that lay their eggs in the bodies of caterpillars and other insect larvae, so that their young, when they hatch out, feed on the tissues of this unwilling host until it dies. Obviously, it is often a bit difficult to deposit an egg in a writhing and terri-



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fied caterpillar, so that if one egg can be called upon to do the work of many it will be a great advantage to the species. And that is what happens. Normally an egg divides into two cells, four cells, eight cells, many cells; and these many organize themselves into a single complete insect larva or grub. The eggs of this group of little wasps, however, do otherwise. In one species the egg divides into two cells, and each of these two then proceeds to subdivide and organize normally, so that twin insects always result. In a cousin species the division goes on until there are 10 or 20 cells before the normal development begins. In a third species one egg develops into 150 individuals, while the egg of the no-race-suicide champion of the whole tribe eventually gives rise to as many as 2,000 young insects.

Rising currents of air, which as all aviators know sometimes amount to strong winds blowing "straight up," frequently carry winged beings much smaller than flying men, and probably play an important rôle in the migration and distribution of insects. Such is the opinion of Dr. E. P. Felt, of Stamford, Conn. Most insects, especially small ones, can not navigate, or perhaps more properly can not aviate, against a strong air current, and when one of these rising drafts catches them it may carry them thousands of feet into the air. Insect traps on airplanes and kites, and on the roofs of tall buildings in the middle of cities, have turned out catches of weak-flying ground hunters that must have been carried miles from their original habitats. Dr. Felt believes that the world-wide distribution of some of the midges, which are very weak fliers, may be accounted for on the theory of these involuntary upward parachute leaps.

The traditional fickleness of a moth will be more than ever confirmed in the minds of romanticists if the scientific findings reported before the Congress of Entomology ever find their way into literary circles. For Professor John H. Gerould, of Dartmouth College, told how he saw the heart of a big moth reverse itself and beat backwards, and then as if to cap the climax, start its beats in the middle and go both ways at once. Insect hearts are not very much like those of the animals with which we are more familiar. They consist essentially of an enlarged tube with muscular walls. The rings of muscle in the walls squeeze together rhythmically, and a sort of wave-like motion sweeps over the organ from one end to the other, forcing the blood along before it. Professor Gerould is of the opinion that this apparently fickle behavior of the insect's heart is of real physiological advantage to the creature itself, however odd it may seem to a human observer.

Similarities in the muscle structures of the legs and mouth-parts of insects and other jointed animals to those of the appendages of earthworms and their kin, are held by Dr. R. E. Snodgrass, of the Bureau of Entomology, U. S. Department of Agriculture, to indicate an evolutionary kinship between the two classes of animals. The musculature of the jaw parts of worms is identical with that of insect maxillae, while the more complicated leg structure of insects is foreshadowed by the muscle arrangement on the locomotor appendages of worms. Caterpillars and similar pests are more numerous in warm weather than in cool. Dr. H. Eidmann, of the University of Munich, experimented with butterflies of several different species, and raised a number of each at ordinary temperatures, another lot in a cold room and a third lot in a room that was kept above 86 degrees Fahrenheit. Although all his butterflies started even so far as potential egg production was concerned, in all cases the ones kept in the high-temperature room laid the largest number of eggs.

A "Yankee invasion" of Mexico to which no Mexican objects but rather welcomes, was described by Dr. Alfons Dampf, chief entomologist of the Mexican Federal Department of Agriculture. Mexican fruit growing, Dr. Dampf said, has been all but ruined by the depredations of a genus of fruit flies known as *Anastrepha*. He has devoted a great deal of his time to a study of this pest, its life and ways, in search of a weak point in its life cycle where it can be attacked with hope of cutting it down. Lately he has received reenforcements from the United States, because one species of the troublesome insect has crossed over into Texas; and an American entomological commission has been established in Mexico City, with full laboratory facilities and a staff of workers. The Mexican and American scientists are cooperating closely in their efforts against the common insect enemy.

THE NEW GEYSER IN THE YELLOWSTONE PARK

THE greatest geyser now active in the world, and with the exception of old Excelsior Geyser, extinct since 1888, the greatest geyser of all history, burst forth into furious and explosive activity a few days ago, and since then has been under scientific observation preliminary to the opening up of a special road or trail to make it accessible to the touring public. Superintendent Horace M. Albright, Dr. Arthur L. Day, director of the geophysical laboratory of the Carnegie Institution of Washington, and Dr. Eugene T. Allen, of the same institution, together with a corps of photographers, have been conducting the investigation of the new phenomenon from the dual point of view of public administration and scientific inquiry.

The new geyser is a Titan of its kind. Its crater is a huge ellipse, 100 feet by 120 feet in its two diameters, and eight feet deep. It erupts in great explosive outbursts, hurling water in all directions and reaching an average height of 60 to 75 feet. Occasional spurts reach a height of 100 feet. It keeps this up at 15 or 20 second intervals for a total of three hours or more, and stages two of these long eruptive periods every 24 hours.

The volume of hot water it ejects is tremendous. The run-off pours through a four-foot gap to a depth of eight inches, at a rate of 120 feet per minute. When an eruption ceases the geyser crater is dry with the exception of a small fissure and several boiling mud springs along the north edge. The end of the eruption

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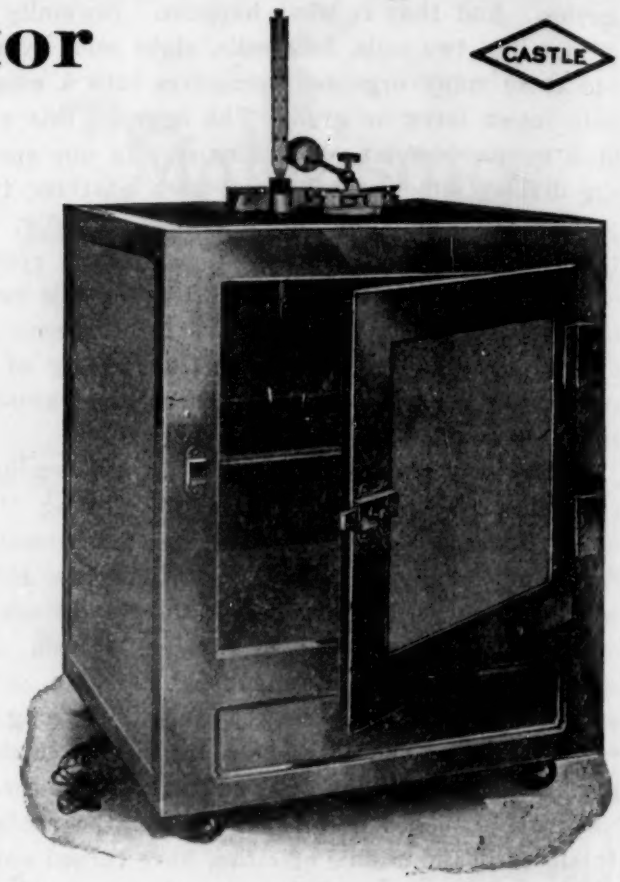

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comes as suddenly as its beginning, and the last of the violent steam explosions seems to be as energetic as at first.

The action of this geyser is so violent, its eruptions so great and its time-intervals so regular that it bids fair to become one of the park's major attractions.

CUBA AND THE AMERICAN MAINLAND

THE theories that dry land once united Cuba with the peninsula of Yucatan and that aborigines of Cuba may have been descendants of the famous Maya race of Yucatan are being discussed at Havana, according to a Science Service correspondent, as a result of discoveries at Lake Mampoton in the province of Pinar del Rio.

A group of American naturalists and archeologists, co-operating with the Cuban naturalist, Dr. Carlos de la Torre, has made soundings and excavations at this lake and has unearthed pots and other utensils bearing designs and inscriptions like those of the Maya civilization. In the same Cuban province, Dr. de la Torre has found fossil remains of mammals of a species which still exist in Mexico, in the hills of Yucatan and Campeche.

Old Maya legends that tell of the flooding of much land support the theory that long ago these animals wandered afoot across what is now the Straits of Yucatan. Much later, when only the high land of the region remained above the sea to form the island of Cuba, it is suggested that the human migration took place by boat. It is believed that Maya chiefs who had been vanquished by more powerful chieftains fled with their people to the unexplored island to the east and there hid from pursuit.

Because of growing interest in the discoveries, further explorations of the region are now under way.

ITEMS

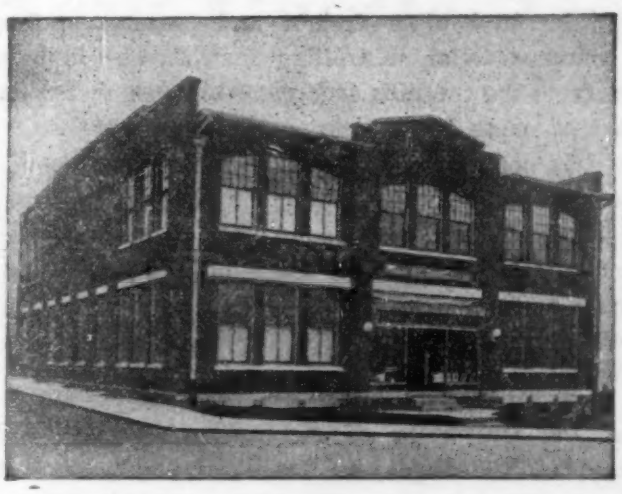
No word has been heard since March from the scientific expedition which set out for the Taimyr Peninsula, one of the most remote points in northern Siberia. The expedition, consisting of Tolmachev, the secretary of the Polar Committee of the Russian Academy of Sciences, zoologist Rogosov and astronomer Malzev, set out early in the year to reach this Arctic peninsula by crossing the Siberian plains. It was the first attempt to gain the Taimyr region overland. Inquiries have been sent to all parts of the region where the expedition may be traveling. No northern radio station of the U. S. S. R. has been in communication with the radio station of the explorers. The only inhabitants of the peninsula who might aid a stranded party are a few wandering Mongols.

THE Pavlov Volcano Expedition, under the leadership of Dr. T. A. Jaggar, of Kilauea Volcano, has added a new volcano to the long string already known in Alaska. The mountain is north of Canoe Bay, and is 4,300 feet high. Its crater contains a small lake. Dr. Jaggar proposes to name the peak Dana Volcano, in honor of the great pioneer American geologist. The amphibious autoboat which the expedition carries is reported to be a great success. It can run on land and cruise in the water, and steel-wire mats make it possible to cross mud flats and oozy sand. It is doing full duty both on land and water in hauling freight and passengers, firewood and camp material, in trolling for fish, and in bringing down from the foothills such game as is shot; Dr. Jaggar speaks of using five bullets to kill a 10-foot bear. As a boat it is not particularly fast, but has been found very seaworthy in heavy seas and in strong currents and tide rips, and has been found able to land successfully through fairly heavy surf. On land it is taken along the beaches and over the tundra quite easily. It makes excellent sleeping quarters for two men whether on land or on sea.

AT the University of Nebraska a setting is being created for the display of fossils of elephants, tortoises and armadilloes many millions of years old. These were found at Niobrara in the valley of the Platte river in western Nebraska. Because of the soft sandstone in that region, parts of the bones were left visible, a circumstance facilitating the task of collecting them. The bones vary in size from the skull of a mammoth to the skeleton of a shrew, the smallest of mammals. The elephant serves as the keynote for the entire exhibit, ten different kinds of elephants having been found in Nebraska.

EVIDENCE suggesting that ergosterol is not the only substance that can be given the power to prevent rickets by exposure to ultra-violet light was presented to the Institute of Chemistry of the American Chemical Society by Mrs. Elizabeth M. Koch, of the University of Chicago. A commercial cholesterol, a substance found in nerve tissue, egg yolks and blood, was exposed to ultra-violet light. It acquired the power of preventing rickets to a high degree, proving about one seventy fifth as effective as ergosterol, which has a very high anti-rachitic potency. When the commercial product was purified its potency was not nearly so great, but heating the purified product in nitrogen under pressure raised the potency to its original degree.

FUTURE advances in the science of immunity, which is the body's resistance to disease, will be made largely by chemists, either alone or in association with immunologists, was predicted by Dr. H. Gideon Wells, of the University of Chicago, at the recent meeting of the Institute of Chemistry of the American Chemical Society. "Immunity may be appropriately called the chemical warfare of existence," said Dr. Wells. "The disease germs attack and kill us by the poisons they produce. Our bodies are constantly producing poisons to defend themselves by killing the germs. Through chemistry we can gain knowledge of just what these mysterious protective agents are, how they act and how to produce them artificially. Then we shall not have to depend on the dilute solutions of these agents that we can extract from a horse or can cause to develop in man's own blood, such as our present serums and anti-toxins, but can give man as much as he needs of the active agent that has been prepared by synthetic chemistry."



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SCIENCE NEWS

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USES OF THE CATHODE RAYS

A NEW apparatus by which the waste products of petroleum stills and coke ovens may be quickly transformed into rubber, alcohol, acetic acid and valuable drugs and perfumes is announced by Professor H. Plauson, of Hamburg, Germany. The active agent is the cathode ray, which is produced in the ordinary X-ray tube, but which is here brought into the open, and made applicable to industrial processes on a large scale by Plauson's tube.

This, he claims, is more economical and efficient than that invented by Dr. W. D. Coolidge, the American physicist, in 1925. In the German tube the window through which the rays pass is of gold-plated beryllium instead of nickel. The current required is only 200,000 volts while Coolidge runs his voltage up to 350,000 or higher.

A further advantage claimed by Professor Plauson is that he is able to direct and focus the rays upon the chemical to be acted upon by placing it in a powerful rotating electromagnetic field which greatly enhances their activity. Under this influence moist air is converted directly into nitric acid. Ammonia is made from a mixture of nitrogen and hydrogen. The unusable gases given off in cracking petroleum to get the highest possible yield of gasoline can be combined with hydrogen or chlorine gas to form useful products. Synthetic rubber may be made from isoprene with astonishing rapidity. The milk from the rubber tree is quickly converted into a solid and insoluble state without the use of sulphur and becomes brittle if exposed too long to the rays. The liquid forms of bakelite are hardened into the solid shape without heating. With coal, water and air as the raw materials it is possible to make alcohol, methanol, acetic acid, ether and all such products as were formerly produced from vegetation.

Dr. Plauson says that the use of the cathode rays opens a new era in synthetic chemistry which is being actively investigated by the Laboratory of the Society for Ray Chemistry at Hamburg.

VOLCANO EXPLOSIONS AND WORLD WEATHER

WEATHER men as well as volcanologists are watching with heightened interest the series of volcanic eruptions which have been taking place this summer, culminating with the explosion of Rokatinda, which is reported to have killed a thousand natives on the island of Paloweh. If the recent eruption was severe enough, or if it is followed by an even greater outburst, there is a chance that the following summer may be abnormally cool.

Professor W. J. Humphreys, of the U. S. Weather Bureau, has made a study of the weather records following periods of intense volcanic activity for the past three centuries, and finds that each great explosive eruption has been followed by one or more cool, cloudy summers. The famous "year without a summer," 1816, followed upon the heels of a terrific explosive eruption of Tomboro volcano, in the East Indies, during 1815. This correlation between volcanic eruptions and weather is believed to be due to the loading of the upper atmosphere with clouds of extremely fine volcanic dust, which stays aloft for months and is carried all over the world.

Volcanic eruptions of the explosive type show a tendency toward grouping. Two or more will occur close together within a couple of years, and then there will be a period of relative quiet until the next group outburst. Thus, one of the earliest group entries on Professor Humphreys' list shows the eruption in 1766 of Hecla in Iceland and Mayon in the Philippines; the latter volcano is in eruption again at present. Between 1783 and 1785 occurred the eruptions of Asama in Japan, Skapta Jokull in Iceland and Vesuvius in Italy. In 1799 there was an isolated volcanic explosion on Tierra del Fuego, off the tip of South America, which may have been responsible for a cool summer following.

From 1808 until 1815 there was a long succession of great outbursts: St. George in the Azores, Etna in Sicily, Soufriere on the Island of St. Vincent, Mayon in the Philippines, culminating in the terrific eruption of Tomboro, which destroyed 56,000 lives. The "year without a summer" followed in 1816; but during this period there were several years of abnormally low temperature.

Fifteen years later, in 1831, a new series began, with explosions in the Babuyan Islands, Mt. Coseguina in Nicaragua and Awatska in Kamtchatka. There followed a long period of relative freedom from great explosions, ending in 1872 with an eruption of Vesuvius, followed by Marapi in Java and Vatna Jokull in Iceland. This series ended in 1875.

In 1883 came the most terrific eruption in the memory of living men, when the great East Indian volcano Krakatoa shattered the whole island on which it stood and wiped out 36,000 Malay lives. This eruption was followed before 1886 by outbursts of St. Augustine in Alaska and Tarawera in New Zealand. The low-temperature period following this group was second only to that of 1816.

The next period was between 1890 and 1892, with explosions of Bogoslov in Alaska, Awoe, in the East Indies and Bandaisan in Japan. Ten years later came the disastrous eruption of Pelée on the island of Martinique, and the outbursts of Santa Maria volcano in Gautemala and Colima in Mexico.

The most recent group of eruptions started in 1912, when Katmai in Alaska blew off its top, followed in 1913 by another eruption of Colima, and in 1914 by Sakurashima in Japan.

The present year has been marked by four volcanic outbreaks. Ometepe, on an island in Lake Nicaragua, erupted in January. There have been reports of explosions at Krakatoa, quiescent since its great eruption in 1883. Mayon in the Philippines has been driving the

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inhabitants of its neighborhood away from their homes, and finally has come the destructive explosion of Rokatinda. None of these has been at all comparable with the great explosions, such as those of Krakatoa and Asama, or even with the eruption of Katmai; but there is no telling whether they may not be merely the preliminary bouts of a really huge outburst, which may again bring us a year without a summer.

COAST GUARD EXPEDITION DISCOVERS BIRTHPLACE OF ICEBERGS

ACCORDING to an amateur radio message from Godhavn, Diske Bay, Greenland, the birthplace of the icebergs that menace the transatlantic steamers has been discovered by the oceanographic expedition of the U. S. Coast Guard on board the SS *Marion*. The ship is now well above the Arctic Circle and has just proceeded across Diske Bay between hundreds of towering ice islands.

"We are now viewing the birthplace of the icebergs of the North Atlantic, the entrance of Jacobshavn Fjord which is literally jammed with thousands of bergs so close that we can not penetrate with the vessel," Commander Edward H. Smith, in command, explained in his report to Science Service.

The *Marion* on its voyage northward in Davis Strait between Labrador and Baffin Land on the west and Greenland on the east has noted the number of icebergs. The scientific men aboard have also charted the ocean currents that bring the icebergs southward to endanger the steamship tracks. The contour of the sea floor that sometimes allows the great ice masses to ground and be delayed in their southward journey is also being investigated.

Commander Smith will shortly head a landing party that will investigate the Greenland ice cap at this point. The rate of movement of the glaciers that drop the icebergs into the sea will be measured. New knowledge of the rate at which icebergs are born of the ice cap is expected as a result of these studies.

CANCER CONTROL BY BLOOD ALKALINITY

CANCER is associated with and possibly controlled to a large extent by the relative alkalinity of the blood. This discovery was made by Dr. Ellice McDonald, chairman of cancer research of the University of Pennsylvania, in an address given at Evanston on August 11 before the American Chemical Society Institute.

Dr. McDonald flatly rejects the germ theory of cancer. At the same time he discounts the idea that cancer cells are of some abnormal species foreign to the human body.

A cancer cell is simply an ordinary body cell which is compelled to live in the wrong liquid environment. The trouble in such liquid medium comes mainly from excess of alkali, coupled at the same time with a low content of calcium in the blood—two factors closely interrelated.

The much-disputed radium and X-ray treatments for cancer are successful, in a limited number of cases, mainly in so far as they reduce the alkalinity of the blood. Experiments have demonstrated an appreciable rise in hydrogen-ion concentration—that is relative quantity of acid in the blood—following irradiation. It is still not clearly demonstrated how or why the powerful rays should succeed or fail in a given case.

'Tis an ill wind that blows nobody good. People cursed with "acidosis" are found by Dr. McDonald to be practically immune from cancer. The blood of such individuals, who are usually of sedentary habits, may reach the figure of 7.2 on the biochemist's scale of acidity. A victim of cancer, however, would show a record of about 7.45. Simply expressed, the latter figure means nearly double the alkalinity (or half the acidity) of the value for the former case.

It is likely that families cursed with cancer are composed of persons sharing a family tendency to run low in bodily acid and high in alkali. It is accordingly quite unnecessary to suppose that the actual disease itself may be inherited. Only the tendency is passed on.

When a body cell finds itself in an abnormally alkaline environment it simply acts like a yeast cell. It grows. Its cell wall expands and becomes more permeable. It divides, and great increases in number and mass occur. As with yeast again, the addition of sufficient acid stops the irresponsible, wild growth of the cells.

Dr. McDonald's work, supported not only by his Philadelphia staff, but also by the recent biochemical discoveries of Rene Reding of Cancer Center, University of Brussels, have thrown a large part of cancer research into the hands of the chemists. Search for new substances capable of correcting abnormal alkalinity is now projected. It is probably not sufficient merely to administer doses of some common acid to a cancer patient. It will be necessary either to attack chemically the fundamental source of alkali, or to foster acid production; these may be one and the same thing. With this will be joined an investigation of new calcium salts suited to the maintenance of decreased alkalinity.

RADIOVISION

RADIOVISION and radiomovies will be received in thousands of homes during the coming winter. Thousands of amateurs and radio enthusiasts will build their own radiovision receivers and early this fall ready-made radiovisors will come on the market. Radiovisors will be the novel and really smart Christmas gift this year. These are the predictions of those behind the scenes in radio experimentation.

Although only three radio stations are regularly broadcasting radiovision or radiomovies, at least seven more are experimenting or testing and installing radio transmitters. The fall months will see this number increased rapidly.

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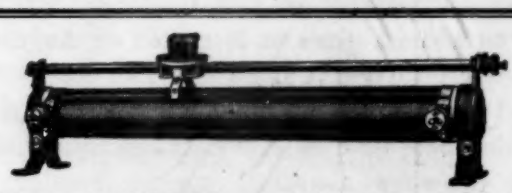

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new and wide bands of short waves for radiovision will spur on the development.

At present radiovision is in a state corresponding to the crystal set days of sound radio in 1921. But the growth of radiovision will be faster than was the growth of sound radio. Thousands have learned to use tools and make their own radio sets. The vogue of home construction of radio sets has waned because it became unprofitable and uninteresting with the growth of the radio industry. Now the latent mechanical urge of the radio fan is likely to be liberated by radiovision and the construction of radiovisors is likely to become a new home occupation.

The well-organized radio set manufacturers, alert for new things to sell, are also expected to place de luxe radiovisors on the market in a remarkably short time this fall.

In the early days of radiovision only the expert amateurs and set builders are likely to obtain consistent and satisfactory results because of the fact that most of the radiovision broadcasts are now on wave lengths shorter than the usual music and speech broadcasts. Their pioneering, however, will make the day of radiovision in the ordinary parlor come sooner.

ITEMS

"No free samples!" was the caution to the audience at the Institute of Chemistry of the American Chemical Society meeting at Evanston, Illinois, when they were shown various types of synthetic gems by Frank B. Wade, of Indianapolis. Mr. Wade reviewed the history of the making of gems, from the first much-disputed rubies from Geneva in 1885 to the present time, when chemically genuine rubies and sapphires have become commonplaces of the market, and even the most prized of all sapphires, the clear blue, can be produced at will.

IF a cow's milk hasn't any iodine in it, this important substance may be put into her milk by feeding her a ration that contains iodine, according to experiments carried out at the Wooster Agricultural Experiment Station. Theoretically, milk contains iodine. Practically, it does not always. Potassium iodide, calcium iodide and a seaweed were fed to cows in the experiment. These cows had produced milk without iodine, but the addition of iodine in any of the above forms caused the appearance of this substance in their milk. In sections where the feeds are rich in iodine the milk contains small amounts as a normal constituent, but in sections where the feed is poor in iodine, it will be absent from the milk unless fed supplementally.

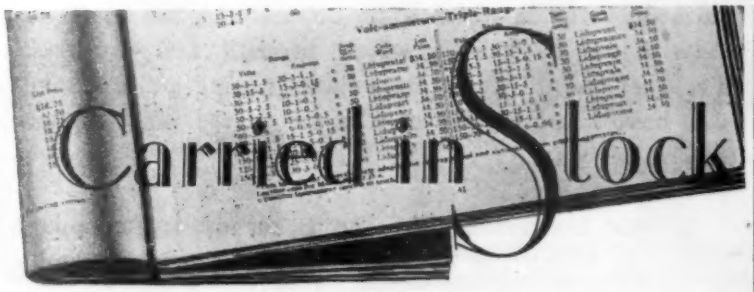
THE man with heart disease, except in very advanced stages, need not be afraid that an accident, either a minor one such as tripping over the rug or a major one in which he falls or is thrown, will affect the function of his heart, causing increased weakness or failure. Dr. W. I. Clark, of Worcester, Mass., reports that as a rule accidents do not affect a diseased heart, and there does not seem to be any special type of accident which is invariably followed by heart failure. Certain exceptions do occur in which after an accident the heart may show signs of failure which persists and progresses. These cases are found especially among older workers who have heart trouble or who are on the verge of heart failure anyway.

A NEW instrument like the ticker of stock brokers' offices, in which the action current of the heart doubles for an electric current, is now being used by physicians to measure the heart beat, instead of the old-fashioned method of counting the pulse with hand and watch. The new instrument, called cardiotachometer, is much more accurate than the old method and can be used to measure the pulse rate under all sorts of conditions of exercise and rest. A pair of electrodes, fastened on the lower left and upper right chest, pick up the current generated with each heart beat, which passes through an amplifier and is recorded by a signal recorder which marks each beat on a moving tape. The instrument was designed by Dr. Ernst P. Boas, of New York City, in collaboration with Dr. Benjamin Liebowitz and Dr. Alfred N. Goldsmith.

WHEN the ship begins to pitch and roll and you feel waves of seasickness overwhelming you, try a salt-water bath. The water should be from 90 to 95 degrees Fahrenheit, its specific gravity 1.020. Lie in the bath with your eyes blindfolded, your body supported lightly at shoulders, buttocks and back of head, with the toes just touching the end of the tub to keep the legs from floating. Stay in the bath for a half hour, an hour, or longer if necessary. This procedure gives great and usually permanent relief within a short time. This method of treatment was worked out by Dr. R. A. Bennett, who used it in extreme cases where exhaustion from seasickness was becoming dangerous. The bath moves as the ship does, but the water has not time to respond to the motion, so it and the patient immersed in it remain fairly motionless.

SMALL boys, getting aching backs and no fun at all hunting potato bugs in the parental potato patch, may well sigh for the company of a few Southern quail. N. L. Wiley, of Beaufort, N. C., states that he has observed these beautiful little game birds eating potato beetles. They seem to be about the only birds that will condescend to such a diet, for even ducks and guinea fowl, which will ordinarily eat anything they can get into their beaks, refuse to touch them.

BORAX has had another use added to the long list of things it is good for, by Professor Robert Matheson and E. H. Hinman, of Cornell University. They have discovered that a concentration of one and one half parts in a thousand of water is very quickly fatal to the larvae, or "wigglers," of mosquitoes that breed in rainwater barrels, cisterns and other exposed reservoirs. The borax seems to hold its larva-killing properties for a long time; one experiment ran from July 25 to September 7 of last year without any signs of weakening at the end.



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THE INTERNATIONAL CONGRESS OF ENTOMOLOGY

Press dispatches by Dr. Frank Thone, staff writer

WAR between humanity and the Hexapods was pictured in unfamiliar colors before the opening session, at Ithaca, of the fourth International Congress of Entomology on August 13. The president of the congress, Dr. L. O. Howard, of the U. S. Bureau of Entomology, in his address printed in SCIENCE, on August 17, pointed out that the prevalent conception of an Age of Man finding its supremacy threatened by a looming Age of Insects is not accurate. The world is still in the Age of Insects, he said, and the Age of Man is not yet established. Taking into account the facts now known about evolutionary history, we must look upon the insect world as the old established order, an animal hierarchy of such exceedingly ancient lineage that it can count even the dinosaurs as a race of upstarts that had their day and ceased to be. It is the race of men, and not only they but all of their warm-blooded relatives, who must be looked upon as the invaders, as the attackers, as those who seek a place in the sun at the expense of the present landlords.

An intimate knowledge of a group of insects which are only too intimate companions of man and his warm-blooded kindred was demonstrated by Dr. Karl Jordan, of the Zoological Museum of Tring, England. Dr. Jordan has made a special study of the often despised, often joked-about, but never-to-be-ignored flea. Fleas display much the same evolutionary variations as do the bigger creatures which unwillingly yield them a living, and they frequently constitute a major problem either because of their too great numbers or because of the disease germs they carry.

Less immediately noticeable, but in the end no less influential in the life of man, are the activities of the vast burrowing underground population of insects and their allies. Their work in the soil of the forest was the subject of Professor I. Tragardh, of Stockholm. All dead things in the forest, wood, leaves, the bodies of birds and animals, receive the attention of innumerable tiny jaws, which share with fungi, bacteria, worms and protozoa the task of reducing them to the dust whence they came and thereby making them the foundation for a new generation of life.

Warfare against insects whose bites or stings plant deadly germs in the human system occupied much of the attention of the members. Dr. R. R. Parker, of the U. S. Public Health Service, outlined the results of researches on Rocky Mountain spotted fever which he and his colleague, Dr. R. R. Spencer, have been carrying on in Montana.

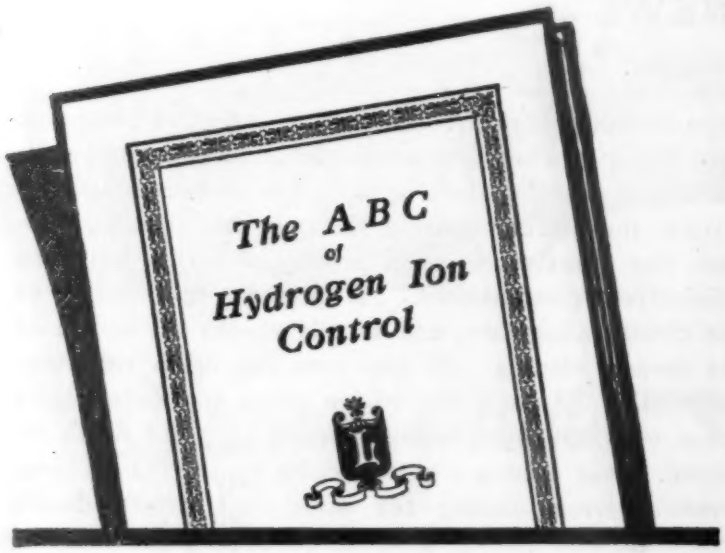
This dangerous disease is curiously uneven in its behavior. In parts of Montana ninety per cent. of all persons who take it die, while in another region, in the neighboring state of Idaho, only five per cent. of the cases terminate fatally. There is no effective treatment once the disease has been contracted, and no control measures have been devised against the ticks whose bites initiate the attack. During the past few months, however, the effectiveness of a preventive serum has been conclusively demonstrated. It prevents mild forms of the disease altogether, and usually checks the course of the severer attacks. It also cuts the death rate very materially. Among the twelve cases contracted in a group of 5,000 serum-treated persons only one death occurred, while among eighteen cases contracted by non-treated persons during the same time fifteen deaths occurred.

Dr. Erich Martini, of Hamburg, Germany, called attention to the need for a better understanding of climatic factors as they affect insect-borne diseases. Sometimes the problem is relatively simple: frosty weather kills flies, and so abates fly-borne plagues, such as some types of dysentery and some epidemics of typhoid fever. But sometimes the operation of climatic factors is not so easily understood. The peak of the annual spread of tertian malaria, for example, comes before the warm weather that is most favorable for mosquitoes. This, upon investigation, seems to be because the malaria germ itself is better able to carry on its mischief-making better in moderately warm than in very warm weather.

Professor W. J. Baerg, of the University of Arkansas, noted among entomologists as the man who has the nerve to let tarantulas, scorpions and centipedes bite and sting him, detailed the results of his first-hand experiences with arthropod poisons. Most of the poisons of spiders and their ugly-looking relatives, he said, are greatly overrated. A centipede bite, even from a big specimen, is about as painful as a bee sting, but no more harmful. The same is true of most tarantulas—and it is usually hard to get a tarantula to bite at all. The much smaller black widow spider of the South is equally reluctant to bite, but its venom is much more wicked in its effects. A black widow bite once put Professor Baerg to bed for three days of rather pronounced illness. But, he added philosophically, it gave him and his attendant physicians a good chance to get an authentic record of the symptoms.

Meet *Trichogramma minutum*. This little insect is a great friend of the human family. Most of us do not know it, because she is too small to be seen, as she goes about the world, doing good to us and ill to our enemies. Trichogramma is one of those interesting though tiny insects that lays her eggs in the eggs of other and larger insects that eat man's crops and orchards. The grubs that hatch out of such parasitic eggs prey upon the larger eggs in which they are laid, and so destroy them. This insect has been known to parasitize the 40 per cent. of all corn borer moths, or 90 per cent. of all cotton caterpillars, in a given area.

To date she has had to take her own chance in the wild state, so that in an unfavorable season there were



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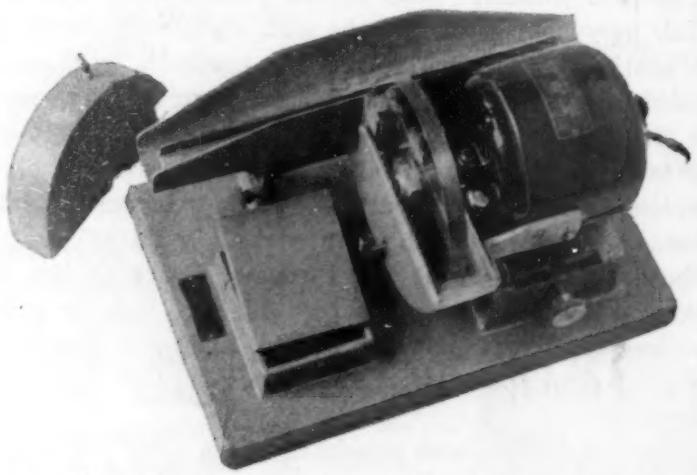

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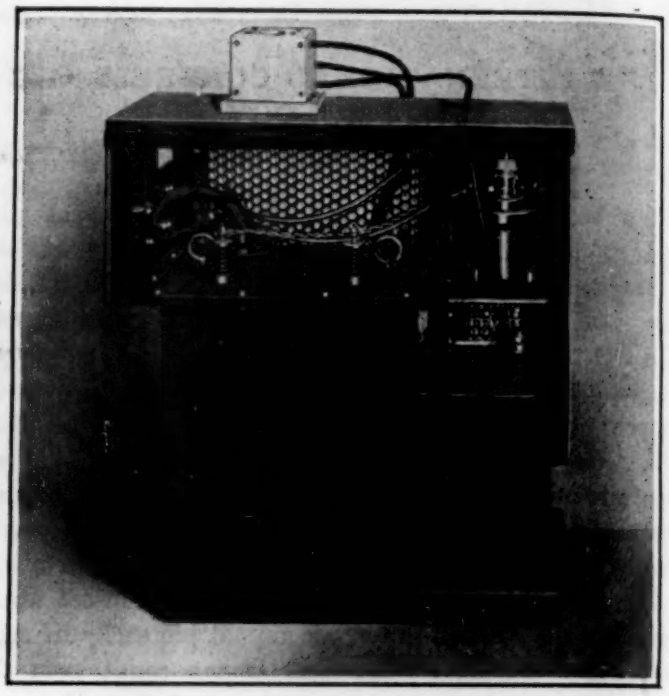

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ELECTRIC FURNACES

not enough of her sisterhood to take care of the eggs of the teeming pests. Now, however, she has been taken in hand by Stanley E. Flanders, of Saticoy, Calif., and brought up in huge numbers in captivity. His method is simple. He first breeds a lot of pests—grain moths—in 40 or 50 bushels of wheat. Then he lets the Trichogramma mothers loose at their masses of eggs. Presently he has perfect clouds of Trichogramma insects, which he then carries out into the California walnut orchards, to mop up the codling moths. Since Trichogramma has uncritical taste in victims, many other insect pests will doubtless be attacked with her aid in time.

A new technique in the handling of another insect friend of man, which has been reared much longer in captivity, was demonstrated by Dr. Lloyd R. Watson, of Alfred, N. Y. He has worked out a method of artificially fertilized queen bees, which will make it possible to breed bees as accurately and scientifically as we now breed cattle. Hitherto the fertilization of the queen has been a matter of chance. By Dr. Watson's method, which involves the use of microscopic glass tubes of unimaginable fineness, the process is made largely mechanical, and the drone that is to be the father of the bee colony can be selected just as accurately as can the queen that is to be the mother.

Locusts, the most ancient of man's insect enemies and one of the worst, are still being fought as they were in the days of Pharaoh. It is in Russia that the campaign is most highly organized and is being fought along most nearly military lines, including the use of chemical warfare methods and combat planes. In Russia and Siberia there are six principal locust species. They breed in waste places and creep about wingless in great mobs while they are young, and it is then they are attacked; for once allowed to grow wings and get into the air they would be beyond all hope of control.

Anti-locust forces sent out by the central government spot these breeding-places, often using scouting planes for the purpose. Once located, they cover with arsenical poison dust the wild grasses on which the young locusts feed, or set sweetened baits of poisoned bran and sawdust. Part of this work is done by ground machines, which might be considered a tank corps; where the ground is difficult, as in marshes, the dusting is done from airplanes.

Locusts were not the only troubles that Pharaoh's farmers had to contend with. Dr. Hassan C. Efflatoun Bey presented results of his researches into the papyri of his ancient fatherland for entomological references. In a complaining letter from the steward of an estate, about 1400 B. C., he found this:

"The worm ate half the crop and the hippopotami ate the other half. The fields were full of rats, a swarm of locusts settled down and fed, the sheep also ate and the birds stole."

Egyptian entomologists, said Dr. Efflatoun, do not now need to go out and catch hippopotami, but they still have plenty of enemies to fight. The "worm" of which the steward complained is still there; it is the common cutworm. And farmers still have to be exhorted to fight it as the farmers of 3,500 years ago were bidden in a royal decree.

An exchange of diplomatic views among allied generals opposing the insect armies was represented by the discussion of Dr. C. L. Marlatt, chief of the bureau of entomology, U. S. Department of Agriculture. Dr. Marlatt spoke on the plant immigration restrictions recently imposed by the United States. These regulations, designed to keep out new insect pests, he said, came very late, long after most other countries had adopted similar measures. Even while they were being debated, between 1909 and 1912, several bad pests and diseases got in, including European corn borer, Japanese beetle, citrus canker and Oriental fruit moth. Since their imposition, however, only two pests have succeeded in breaking through. These were the Mexican fruit fly and the pink bollworm, both of which crossed the southern frontier, admittedly much harder to guard than the seaports.

The marches of the early armies of insects, in the days when there was no human race to oppose their progress, poison and traps and other paraphernalia of war, are the subject of much discussion at the meetings of the congress. Their fossil chronicles in rocks a hundred million years or more in age have been read by careful human historians who are reporting their findings.

Northern Russia and Siberia had an insect fauna much like that of Kansas away back in the Permian Age, before even the dinosaurs had established their sway on the earth. Dr. Andreas B. Martynov, of Leningrad, reported new discoveries in the rocks of Russia that thus link up the ancient history of the two hemispheres.

From the opposite end of the earth, F. W. Edwards, of the British Museum, brought a story of modern evidence on ancient migrations. Mr. Edwards has spent two years in the far south of Chile, in the southernmost forest of the world. There, under trees much like our northern beeches, he found insects belonging to the same genera as those of Australia, Tasmania and New Zealand. Most of this area had been unvisited since Darwin as a young man had tramped over it nearly three quarters of a century ago. Mr. Edwards failed to find evidence there of a former land bridge connecting South America with Australia, but found some support for the so-called Wegener theory, that all the continents of the earth were once one solid land mass, and that the two Americas have drifted westward, floating on a semi-liquid layer of rock beneath.

Further support of Mr. Edwards's findings was supplied by Dr. E. C. Van Dyke, of the University of California, who told of the migrations of North American insects, by Dr. W. M. Wheeler, of the Bussey Institution, Cambridge, Mass., from his studies on the ants of South America and Australia, and by Professor E. L. Bouvier, of the Museum of Natural History, Paris, who has been working with the most primitive of all the creatures that walk the earth on jointed legs.

The myriads of tiny creeping things that live in the upper layers of the soil under the trees of the forest have changed but little in their preferences through almost uncounted ages, according to a note contributed by Dr. R. I. Tillyard, chief entomologist of the Australian Government. He stated that he saw in England fossil plants from the Devonian Age, a period so remote that geologists hesitate to estimate its age in years.

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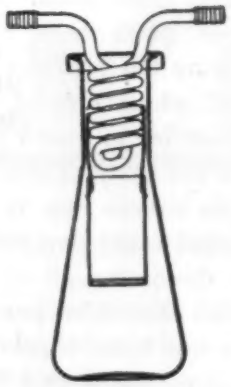

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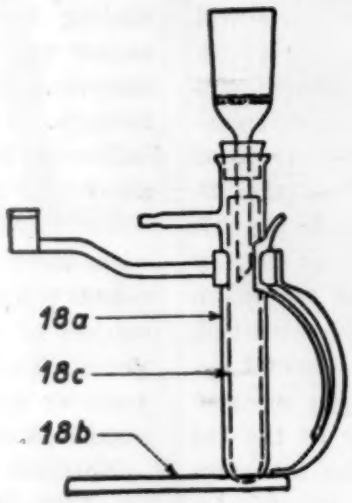

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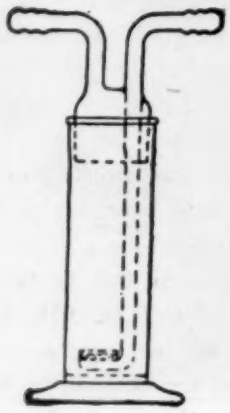

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The plants then were utterly unlike the plants of to-day; yet the tiny life that crept among their tangled stems when they died rather closely resembled the life of the same habitat to-day not only in the families represented, but in the relative numbers of individuals.

A paradox of pests, wherein man encourages insects to prey on plants, prevails in the Antipodes. The secret of it is that the plants are weeds and in devouring them the erstwhile pests are unwittingly serving their cleverer opponent. This biological control of troublesome weeds is developing into a distinct branch of entomological science, which was discussed at the closing sessions of the congress.

The discussion also served to illustrate the fact that Britain's far-flung battle-line exists in other fields besides the military. The three men who, with their assistants, are cooperating to fight the weeds of Australia and New Zealand are Dr. R. J. Tillyard, of Australia; Dr. Ernest Marsden, of New Zealand, and Dr. A. D. Imms, of England. Australia's most terrible weed is the common prickly pear cactus, introduced from America. To prevent it from completely overrunning warmer parts of the island, the cactus regions of the United States were combed for insects that would eat cactus and nothing else. The search has been very successful, and the Australian cactus pest is now well under control. The many-legged allies of man in this fight against a vegetable include the cochineal bug, cultivated in Mexico for red dye, several other true bugs, the caterpillars of three moth species, and a variety of the almost microscopic red spider.

In New Zealand there are three introduced weeds that are very troublesome, the common blackberry, the European gorse, and the ragwort, a plant allied to the dandelion and quite poisonous to livestock. A moth species has been found whose caterpillars will take care of the ragwort situation, and a feeder on the gorse also gives promise. A third caterpillar has been tried out for the blackberry pest, and a beetle whose grubs bore into the stems may also be useful.

This introduction of destructive insects to prey on weeds is admittedly a ticklish job, for if one of them should turn on an economic plant instead of the weed for which it is intended, the remedy might itself become a disease. However, the insects are all kept most carefully caged until they are tried out on all possible diets in addition to the one for which they were imported, and if they show a taste for a valuable plant they are at once destroyed. This period of quarantine also serves to clear the insects of their natural parasitic enemies before they are released. As an insurance measure, however, a stock of parasites of each species is kept available, so that if one of the devourers should go wrong it could have a counter-attack launched against it.

For the warfare on the home front, here in the United States, chemists are seeking new weapons. The arsenates of lead and of copper, or Paris Green, which are the staples of present-day Borgian banquets for bugs, may soon be varied with arsenates of other metals, such as aluminum, iron, magnesium, barium and zinc, with additions of such things as thallium, sulphate, copper cyanide and various fluorides and fluosilicates. In addition, stated Dr. R. C. Roark, of the bureau of chemistry and soils of the U. S. Department of Agriculture, some 400 patented moth-proofing compounds are being investigated for their possible usefulness in man's chemical warfare against the insects.

The present congress is hailed as the most successful meeting of its kind ever held. Over 600 persons attended, including 100 foreign delegates representing some 35 countries. The halls were a friendly Babel of languages. Frenchmen spoke German to Germans, and Germans replied in French to Frenchmen. Belgians, Czechs and Russians spoke both languages to each other. There was very evidently no question of frontier or race in this meeting of the Scientific General Staff.

The next Congress of Entomology is to be held in Paris in 1932.

ITEMS

TUNGSTEN, a few years ago so rare that it was a curiosity even to chemists, is now a household necessity and a household word. Its near relatives, tantalum, molybdenum and columbium, while not so universally familiar, are now produced quite as readily, and are finding an increasing use in industry, Dr. C. W. Blake, of Highland Park, Ill., told members of the institute. The handling of these metals on an industrial scale presents its difficulties. The melting points are among the highest known for metals, and in order to prevent oxidation during melting, the process has to be conducted in a vacuum or under an inert gas such as neon or nitrogen. At the same session Francis M. Foley, of Pennsylvania, discussed the handling of various types of alloy steels. Some of the metals he described, designed especially for resisting corrosion, contain more nickel, chromium and tungsten than they do iron.

THE familiar "drops" which the doctor puts in the eyes before examining them do not have the same effect of enlarging the pupils in eyes of other races, members of the American Pharmaceutical Association, K. K. Chen and Edgar J. Poth, of the Johns Hopkins Medical School, reported at the recent annual meeting. Chinese, for instance, and Negroes are not so affected. The reason for this peculiarity of Chinese and Negro eyes is not known. In the study a very delicate instrument called a filar micrometer, which measures to one-hundredth of a millimeter, was attached to a telescope and used to measure very accurately the dilation of the pupils under controlled illumination. Five kinds of "drops" were studied: synthetic, natural and pseudo-ephedrine, and cocaine and euphthalmine. The last two are in more general use. For the examination of Chinese and Negro eyes there remain two solutions, homatropin and atropine, which do dilate the pupils. However, these two are dangerous for persons who have an eye disease called glaucoma.

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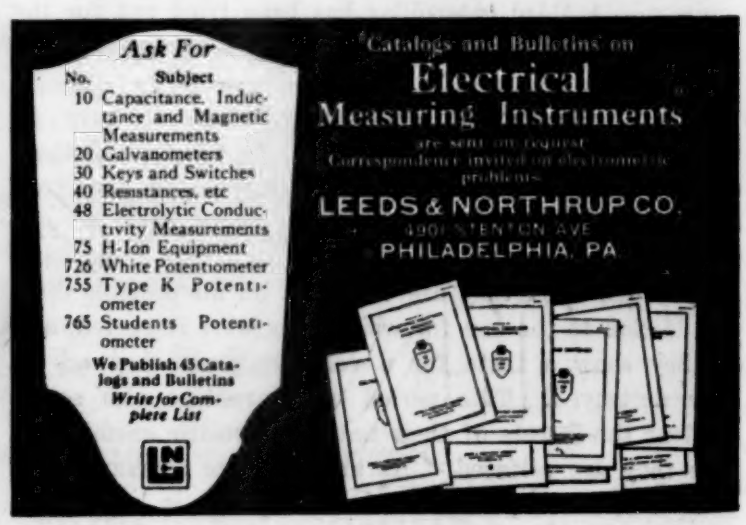

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SCIENCE NEWS

Science Service, Washington, D. C.

COSMIC RAYS

Dr. Robert A. Millikan and Dr. George H. Cameron, of the California Institute of Technology, have just reported to the National Academy of Sciences the results of their latest researches on the biography of atoms. The work that he has been doing for the last few years has demonstrated, says Dr. Millikan, "that the cosmic rays are the signals sent out through the heavens of the creation of the common elements out of positive and negative electrons." The electrons are the building units of which all atoms are believed to consist.

The next important question, he says, is "Where are these creative processes going on?" Now, he believes, he can answer this with a considerable degree of assurance. He thinks that it is in interstellar space.

Only two possible places are conceivable where such atom building can take place, he says. One is in the stars themselves, where pressures, densities and temperatures may be extraordinarily high. The other is in the interstellar spaces where "pressures, densities and temperatures are all extraordinarily low."

"In both of these localities," he remarks, "matter exists under extreme and as yet unexplored conditions, and in view of the last thirty years of physics it would no longer be surprising if matter were again found to behave in some hitherto unknown and unexpected way as a new field of experimentation is entered."

The first reason that leads Dr. Millikan to reject the stellar origin of the cosmic rays is that in such a case the sun, closest of all stars, should by virtue of its closeness, send us more of the rays than any other star. "But the fact is," he states, "that all observers are agreed that the change from midnight to midday does not influence the intensity of the cosmic rays. This can only mean that the conditions existing in and about the sun, and presumably also in and about other stars as well, are unfavorable to the atom-building processes which give rise to these rays." Consequently, the favorable conditions must be found away from the stars.

The second reason has to do with the measurements of the absorption and total energy of the rays. The hardest and most penetrating of the rays observed are completely absorbed in passing through 70 meters of water. "This means," says Professor Millikan, "that, even if the atom-building processes went on inside a star, the resulting cosmic radiation could not possibly get out, but would all be frittered away in heat before emergence, save in the case of those rays that originated in the star's very outermost skin—a skin equivalent in absorbing power to a hundred or so meters of water."

But the total energy coming to the earth in the cosmic rays is about a tenth of that in the light and heat coming from all the stars except the sun. This could not be the case if the rays originated within the stars, for then the rays from the interior, as they emerged through the outer layer of the star, would be transformed to heat. The heat outflow would then be more than ten times as great as the flow of the rays from the star's surface. This, also, leads to the conclusion that the origin of the rays is in interstellar space.

Modern astronomical views accord with this theory. These propose that the energy of the stars is furnished by disintegration of their atoms. The atoms, it is supposed, break up into the electrons of which they are made, and so turn into a pulse of energy which is frittered away as heat. There should be a ray, then, corresponding to this pulse of energy, of even shorter length than the shortest and most penetrating of the cosmic rays. Such a ray has not yet been found, but Dr. Millikan points out that this is no evidence that it does not exist within the stars. It may all be turned to heat before it gets out.

For these reasons, therefore, Dr. Millikan and Dr. Cameron suggest the cycle of atomic life. The electrons are floating around freely in interstellar space. Under the influence of the peculiar conditions of outer space they condense into atoms. The atoms then condense into stars, and the stars again disintegrate into ether waves and heat or light.

Only one more step remains. Dr. Millikan points out that if this is the whole process, all the free electrons of which atoms are built should have been used up long since. "The only possible answer," he says, "seems to be to assume that these building stones are continually being replenished throughout the heavens by the condensation of radiant heat into positive and negative electrons with the aid of some, as yet, wholly unknown mechanism." To work out this mechanism is the next step.

THE SPEED OF LIGHTNING

The speed of a lightning flash has been measured for the first time in history. It takes about one seven-thousandth of a second for it to complete itself. No part of it lasts more than approximately one thirty-five-hundredth of a second.

The old dispute as to whether lightning strikes downward from the clouds or jumps upward from the ground has also been settled. It does both. It starts from the cloud and the ground at nearly the same instant, and approximately one seven-thousandth of a second later the two ends unite in mid-air.

These facts, representing the first actual measurements of the speed of lightning, were determined by Dr. C. V. Boys, British physicist, who is spending the summer working in the private laboratory of Mr. Alfred L. Loomis, of Tuxedo Park, N. Y. Professor Boys obtained his measurements with a special camera which he has patiently carried about the world for twenty-six years, attempting hundreds of photographs in vain, until a New York stroke of lightning proved to be his real stroke of good luck.

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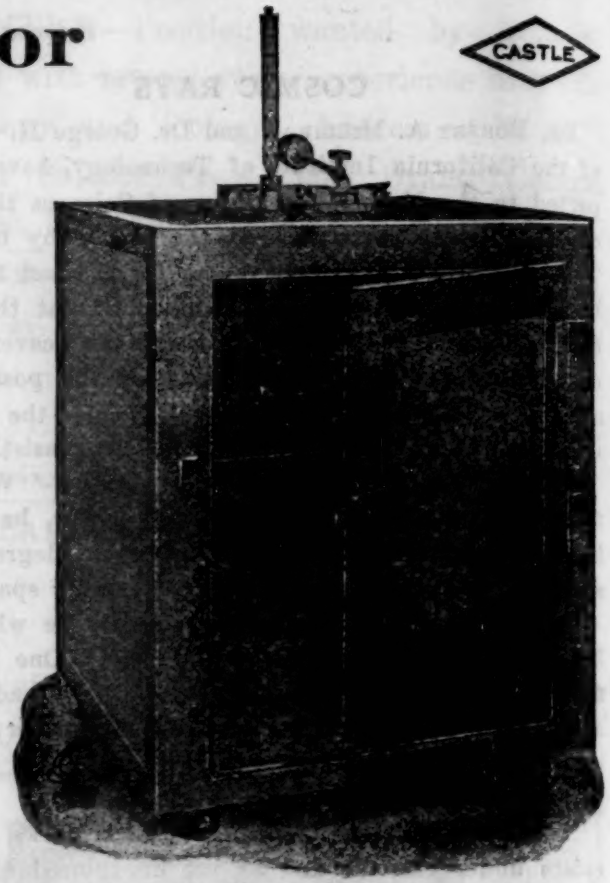

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A detailed report of these measurements and a description of the methods employed are published in *Nature*.

SYNTHETIC CANE-SUGAR

THE proposition of commercial synthetic cane-sugar is pure "moonshine," in the opinion of Sir James C. Irvine, Britain's greatest sugar chemist, speaking at the Institute of Chemistry of the American Chemical Society at Evanston. Even admitting that the two mother substances of common sugar, glucose and fructose, were to be obtained from nature, the last step in uniting the two presents enormous difficulties. Apparently there is little hope of a process much more economical than that of Professor Ame Pictet, whose discovery of synthetic sugar received wide publicity recently.

In a survey of the very difficult laboratory researches leading to synthetic sugar, Sir James pointed out the chameleon-like habits of both glucose and fructose. Each of these, instead of being a single kind of sugar, is really a small host in itself. Actually several different species of sugar ride under the one common name. While these are naturally much alike, it is only one particular kind of glucose combined with one specific fructose which will yield genuine cane-sugar. To add to the problem, the different varieties change into one another, unobserved, during manipulation.

A change from one variety of glucose or fructose to another is usually the transfer of oxygen atoms from one carbon atom to another within the sugar group. No material is lost or gained, so that the ordinary analytical chemist, using balances and common laboratory apparatus, would not suspect that anything had happened. Neither Pictet nor Irvine has yet demonstrated clearly just what kind of each sugar goes into the cane-sugar combine, so that it is still impossible to write the formula of the final product with certainty.

Although the glucose component is commercially available at low cost from corn, the fructose is more expensive than natural cane-sugar itself. In view of the fact that the production of a teaspoonful of synthetic cane sugar would probably take the time of a highly-paid chemist for several months, to say nothing of supplies and overhead, it is thought that the practical production of sweetness will be left to the lowly beet and cane for a long time.

FISH CULTURE IN THE SOUTHERN STATES

A GIANT Brazilian shad weighing 200 pounds, another big fish known locally as "dourado," and a fresh-water species with red-gold flesh like a salmon, are among the South American fishes recommended as possibilities for fish culture in the southern United States by Dr. R. von Ihering, the Brazilian naturalist.

The possibilities of Brazilian fresh-water fish have only begun to be realized even in Brazil, Dr. von Ihering states. Hitherto they have attracted only the attention of zoologists and local fishermen, but now economic studies are being undertaken, with interesting results.

The real prize of the Brazilian fresh waters is the "dourado," a fine black-striped gold-scaled fish that reaches a length of three feet and a weight of 60 pounds. It yields a great mass of roe as well as of marketable meat; its eggstock frequently contains as many as two and one half million eggs, as against a mere half-million in such familiar fish as the carp and members of the salmon family.

The fish with the salmon-colored flesh is known to the native Indians as "piracanjuba." It is rated second only to the dourado by them. One of their favorite methods of preparing it is to grind up its red flesh and make it into a thick soup or porridge mixed with tapioca.

Dr. von Ihering states that there are so many fish in the Brazilian streams that during the spring when the runs take place, they can be netted by the boatload at the foot of every waterfall. A casting net nine feet in diameter often brings in ten or twenty large fish at a haul.

THE SPROUTING OF OATS

HARDSHIP in youth is good for oats, as it is said to be good for human beings. This grain of the North thrives best and ripens earliest when it is sprouted at a low temperature, experiments by Prof. N. Maximow, noted Russian plant physiologist, indicate.

Professor Maximow exposed seed grain to temperatures of about 42 degrees Fahrenheit, only about ten degrees above freezing. The stalks from these seeds headed out earlier than those from seeds sprouted at a warmer temperature. This was true even when the early chilling period lasted only for a few days, and the two lots of grain were grown at the same temperature for the rest of their lives. It was found that this treatment held good for all plants that have a late ripening period.

The experiments give scientific point to an old Russian folk saying: "If you want to grow rich fast, sow your oats in the mud." It has long been held by the peasants that the best time for sowing oats is while the fields are still muddy (and hence chilly) from the melting of the winter's snow.

Another striking example of the effect of early influences was obtained by Professor Maximow, working on the influence of light. He found that the effects of artificially lengthening or shortening the day for plants were just about as pronounced when the treatment was carried on for a short period during the early seedling

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Write for Bulletin 273

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stage as when it was persisted in to maturity. According to its specific nature, a plant would ripen its seeds early under the stimulus of lengthened or shortened daylight hours, even though that stimulus had been applied weeks before the ripening period and then withdrawn.

Plants are not concerned primarily with the whole of the white daylight when they respond to artificial darkening, Professor Maximow discovered. He tried cutting off parts of the light supply, and found that when red and yellow light was withdrawn the plants acted as though they were in the dark, so far as their response to the length of day was concerned.

PHOTOGRAPHS AND CHARACTER

READING fortunes in faces is impossible for practical purposes, according to two psychologists who have conducted an experiment to determine whether vocational aptitude and success can be judged by careful study of photographs.

College graduates destined to become famous lawyers or surgeons carry no shining mark of success upon their youthful faces in photographs, at least none that an employer can rely upon. College boys who will never rise beyond a clerk's desk in a law office are apt to look just as keen and promising at graduation time.

The psychologists, Dr. Carney Landis and L. W. Phelps, of Wesleyan University, selected the five most successful lawyers, doctors, teachers and engineers in a big university class that graduated 25 years ago, and also the five graduates who have attained the least worldly success in each of these fields. Photographs of the 40 men taken at graduation and 25 years later were shown to psychology students, who judged the success or failure of each and the line of work that would suit him best.

"In practically every case the observers disagreed and the same subject might be assigned to from ten to fifteen different vocations," the psychologists state, in reporting their investigation to the *Journal of Experimental Psychology*.

One successful engineer was thought by 10 of the 20 student judges to be a clergyman. Six of them thought he was a successful clergyman and four decided that he was a failure at his church career. Another man, who, 25 years after graduation, holds a minor teaching post, was rated as a successful banker by six of the judges.

The popular belief that we can judge a man's ability and personality from seeing his photograph is not borne out by the evidence, the psychologists conclude. A photograph included in a letter of application for a job will not enable an employer to gain any positive idea of an individual's talents or his character.

ITEMS

A NEW treatment for prolonging the lives of stored apples attacked by a disease called "brown heart" is recommended by Dr. C. West and Dr. and Mrs. F. Kidd, working at the Low Temperature Research Station at Cambridge, England. Apples continue to live and breathe after they have been removed from the trees, and this breathing soon contaminates the atmosphere of the place they are stored in with an excess of carbon dioxide, which causes the serious disease, "brown heart." The experiments made here showed that by keeping the apples in a "gas store" in which there is about 11 per cent. of oxygen and 10 per cent. of carbon dioxide, the breathing of the apples is reduced and their storage life increased by from 50 to 100 per cent. Accidental variations in the ventilation is suggested by these investigators as the cause of the present uncertain success in overseas transport of apples.

OF the 1,177 different kinds of trees that are found in the forests of the United States, 137 have special medicinal virtues, Professor Ernest F. Stuhr, of Corvallis, Oregon, told members of the American Pharmaceutical Association at the opening session of the Portland annual meeting. Professor Stuhr has made a comprehensive investigation of all the trees in the country which are now or may be of medicinal value.

IN 1880 jellyfish were observed to be gaily swimming about in the huge fresh-water tank which houses the large Victoria regia lily in the Botanic Gardens, Regent's Park, London. No one knew how these jellyfish first entered the tank. Their appearance was a complete mystery, but they were quite welcome, as they looked very pretty moving slowing about like small electric light globes. For three years they inhabited the tank, and then in 1883 they disappeared as suddenly as they had come. It was thought at first that the draining of the tank for six months in the year probably explained the mystery, for no jellyfish like being out of water. Now after an absence of forty-five years the jellyfish are once more swimming in the same tank in which they were first found. This family of the jellyfish has never been found at any other place except Regent's Park.

HAVING imported eucalyptus trees from Australia to supply timber for mining purposes, the South Africa Department of Agriculture has now been obliged to import wasps on a large scale, to protect their new trees from attack by the snout beetle. The latter had become a serious pest among these giant trees in South Africa, although Australian and American trees have not suffered from it. Investigations by F. G. Tooke, of the South African Department of Agriculture, showed that this insect is also present in Australia, but that it is not at all dangerous because it is itself attacked and killed by a tiny wasp, which lives parasitically in the eggs of the snout beetle.

THE commercial canners are beginning to realize that aluminum may turn out to be the ideal material for the manufacture of containers for canned foodstuffs. Dr. H. Serger, a German investigator, has already obtained encouraging results on this point. He has found that aluminum is much less attacked by fruit acids than is the tin of the usual tinned iron cans.

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SCIENCE NEWS

Science Service, Washington, D. C.

ENERGY AND COSMIC RAYS

A BILLION years from now water, air, earth and iron, in the form of hydrogen, oxygen, silicon and iron, will continue to be the chief constituents of the earth, just as they are to-day. The energy used by mankind will continue to come from the sun, or perhaps from another sun that may have been formed when our present one is used up. There is no danger that scientists, in their efforts to "split the atom," may start a world-wide atom-splitting that will result in the complete annihilation of the earth in a burst of energy.

This was the reassuring message brought to the Society of Chemical Industry by Dr. Robert A. Millikan, director of the Norman Bridge Laboratory of Physics of the California Institute of Technology, who was awarded the Messel medal of the society in recognition of his work.

But his address also contained a pessimistic note. Energy can be made from the gathering of atoms of hydrogen to form heavier elements, especially helium, oxygen, silicon and iron. Out in the space between the stars this is probably happening. Can not man take the enormous quantities of hydrogen that exist as water in the oceans, and turn them into these elements? Dr. Millikan thinks that this is forever beyond the reach of mankind, for, he said, "the indications of the cosmic rays are that these atom-building processes can take place only under conditions of temperature and pressure existing in interstellar space."

In suggesting this source of energy Dr. Millikan departed from previously held ideas. With the discovery of radium by Madame Curie about thirty years ago, it was found that it and allied elements are constantly disintegrating into simpler elements with the liberation of energy. Many have thought that a similar process was taking place in all the elements, though too slowly to be observed in the small quantities available for laboratory study. On the whole, however, it was thought, it might be great enough to be an important source.

Einstein's discovery that mass must disappear if energy is to appear, combined with the development by F. W. Aston, an English physicist, of the relation between the weight of the atom and the mass of the electron at its center, show that this is not true, said Dr. Millikan. An atom with a weight less than a hundred times that of hydrogen can not disintegrate like radium. As 99 per cent. of the earth consists of elements of lower atomic weight than 100, we do not get much energy from this source. In fact, he said, "the energy available through the disintegration of radioactive or any other atoms may perhaps be sufficient to keep the corner peanut and popcorn man going on a few corners in our larger towns for a long time to come, but that is all."

It is this fact, also, he stated, that shows how unjustified are the fears of the "advocates of a return to the 'glories' of a pre-scientific age who have pictured the diabolical scientist tinkering heedlessly, like the bad small boy, with these enormous stores of sub-atomic energy and some sad day touching off the fuse and blowing our comfortable little globe to smithereens." If man ever does learn to disintegrate atoms, and he probably will, he will have to do it by putting energy into the process.

It is the cosmic rays that he has studied in collaboration with Dr. George H. Cameron, his colleague, that indicate the formation of energy in the building up of atoms out in the space between the stars. In previous addresses Dr. Millikan has made this suggestion, and now he believes that he knows just which atoms it is that are being made. Utilizing the discoveries of Aston and Einstein, he says that he has found that only in the formation of helium, oxygen, silicon and iron out of hydrogen could rays of such penetrating power as he has observed in the cosmic rays be produced. He has worked out also the penetrating power that the rays from the formation of each of these elements should have. In very recent experiments he has found that these rays are not all of the same exceedingly short wave-length. Nor are they uniformly spread over a range of wave-lengths, like light from a white hot poker. Instead, there are four bands in their spectrum, corresponding to four approximate wave-lengths, or four degrees of penetrating power. The most penetrating rays, with the shortest wave-length, are capable of going through 200 feet of water or 18 feet of lead. Other groups of the rays are of less penetrating power, but these different degrees of penetration, observed in the experiments, correspond very closely to those calculated for the rays from the principal elements.

"The agreement," he announced, "is better than our observational uncertainty, and leaves no doubt whatever in our minds that the observed cosmic rays are in fact the birth cries of the infant atoms of helium, oxygen and silicon. We have some little indications that we can also hear the shriller birth-squeaks of infant iron, but we are not as yet ready definitely to assert it."

RESEARCH IN ORGANIC CHEMISTRY

How the chemist broke through the barrier between the mineral kingdom and the vegetable and animal kingdoms a hundred years ago, and how far he is likely to go in the production of artificial compounds in the future was the theme of the opening discourse of the distinguished British chemist, Dr. Jocelyn Field Thorpe, of the Imperial College of Science and Technology, London, at the first session of the American Chemical Society on September 11.

The society met on the centennial of an epoch-making event in the history of science, the synthesis of urea by the German chemist, Friedrich Woehler, of Göttingen University. This achievement dissipated the ancient superstition that some mysterious vital force was essen-

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tial to the formation of the foods, flavors, perfumes, drugs and dyestuffs which had hitherto been found in plants and animals. But when Woehler, in 1828, succeeded in preparing urea, a waste product of animal life, from ammonium cyanate, a well-known salt, the discovery opened the way to the manufacture of an immense variety of useful compounds during the next century, ranging from such dyes as indigo to such medicines as camphor. The latest chemical dictionary describes the making of some 400,000 compounds of carbon. Some of these are to be found in nature, but most of them were not in existence until they were made in the laboratory by chemists following in the footsteps of Woehler. As to the future, Professor Thorpe says:

"It is pertinent to ask when additions to this already stupendous list are likely to cease. The answer is that it is never likely to cease and can not cease so long as fundamental research work in organic chemistry is being carried on. These compounds are not, as certain of our maligners suggest, prepared for the sake of preparing them but are merely steps incidental to the elucidation of some problem of fundamental importance to the progress of the science. It is absolutely necessary that these should be recorded in order that subsequent workers in the same field may utilize them as sign-posts indicating the direction along the paths already trodden. In no other way can we hope to explore and map the unknown country ahead of us. I have heard it said that organic chemistry is reaching finality, but to those of us who know, the realization that we have only scratched the surface of things is very evident. Many natural substances, such as strychnine, morphine and so forth, still evade the skill of the synthetic chemist. The wonderful researches of Willstaetter, who has enriched every branch of the science he has touched, have indicated the manner in which the coloring matter of flowers and plants may be investigated."

THE UTILIZATION OF AGRICULTURAL WASTES

GETTING money out of straw, cornstalks, grain hulls and other farm wastes is one of the major jobs that modern agriculture has to face, as industry faced and solved the by-products problem a generation or more ago. This is the opinion of Henry G. Knight, of the U. S. Department of Agriculture, set forth before the American Chemical Society at its annual meeting.

The problem is by no means an easy or a simple one, Dr. Knight believes. With a given waste product, like straw, many things are chemically possible, but they may not be economically feasible. Straw may be made into paper, building board, fuel briquets, cattle feed, several different kinds of fertilizers, or it may be simply burned to get it out of the way. Which course should be pursued in any particular part of the country will have to depend largely on economic considerations.

Some large industrial firms are undertaking the solution of their own farm-product problems. A large milk-chocolate concern owns its own dairy farms and sugar plantations. A paper mill in the South, finding a surplus of hydrogen on its hands, has gone heavily into peanut-planting in order to get a supply of oil for hydrogenation. Automobile and tire manufacturers have set out their own rubber plantations. The speaker expressed his doubts, however, of the long-run economic and social benefits of industry going into agriculture on a large scale and changing the status of the farmer from that of an independent landowner to that of a hired worker.

Dr. Knight predicted the possibility of severe upsets in agricultural economy by the development of new industries based on the utilization of waste products. If cornstalks are converted into rayon, which probably would not be of great material aid to the corn farmer in the aggregate, the market for cotton goods is diminished, which is of concern to the cotton farmer. The fungus, *Aspergillus niger*, which makes citric acid out of sugar, works to the advantage of the sugar-beet grower and the sugar planter and to the disadvantage of the grower of lemons. The ruin of the madder and indigo plantations by the development of the synthetic dyestuffs industry is a historical incident that may hold a lesson for to-day.

FLAX WASTE AND CORNSTALKS

CELLULOSE, that all-important raw material of the new industrial development, which means paper, rayon, automobile lacquer, explosives, toilet articles, is reaching into all corners of plant production and gathering up what once was waste. Members of the American Chemical Society, at their Swampscott meeting, considered neglected sources that might yield paying quantities of the valuable stuff.

Earl R. Schafer and Mark W. Bray, of the U. S. Forest Products Laboratory, Madison, Wisconsin, told their fellow-chemists of the cellulose possibilities offered by waste flax stalks, left over after they have been threshed for linseed. Such stalks are not used for making linen, and have hitherto been a dead loss. The long fibers of the stalks, known technically as "bast," are nearly pure cellulose and hence of potential value. But they are mixed up with shorter fibers known as "shives," which have sticky and woody constituents, and these shives must be separated out before the cellulosic bast fibers can be of full use. Flax pulp as now made still has too large a proportion of shives in it, but the speakers expressed the opinion that further purification would make this pulp a valuable product.

The perennially discussed cornstalk came in for a round with the paper of H. A. Webber, of Iowa State College at Ames. Mr. Webber is a colleague of Professor O. R. Sweeney, one of the foremost authorities on cornstalk utilization. The total production of cornstalks in the United States each year is estimated at approximately 175,000,000 tons. The average yield per acre of dry stalks in the corn-belt states is two tons, of which 1.5 tons are available for use as a source of cellulose. The cellulose content of the stalks is approximately 35 per cent. To get it out, much the same methods can be used as are now employed for producing cellulose from

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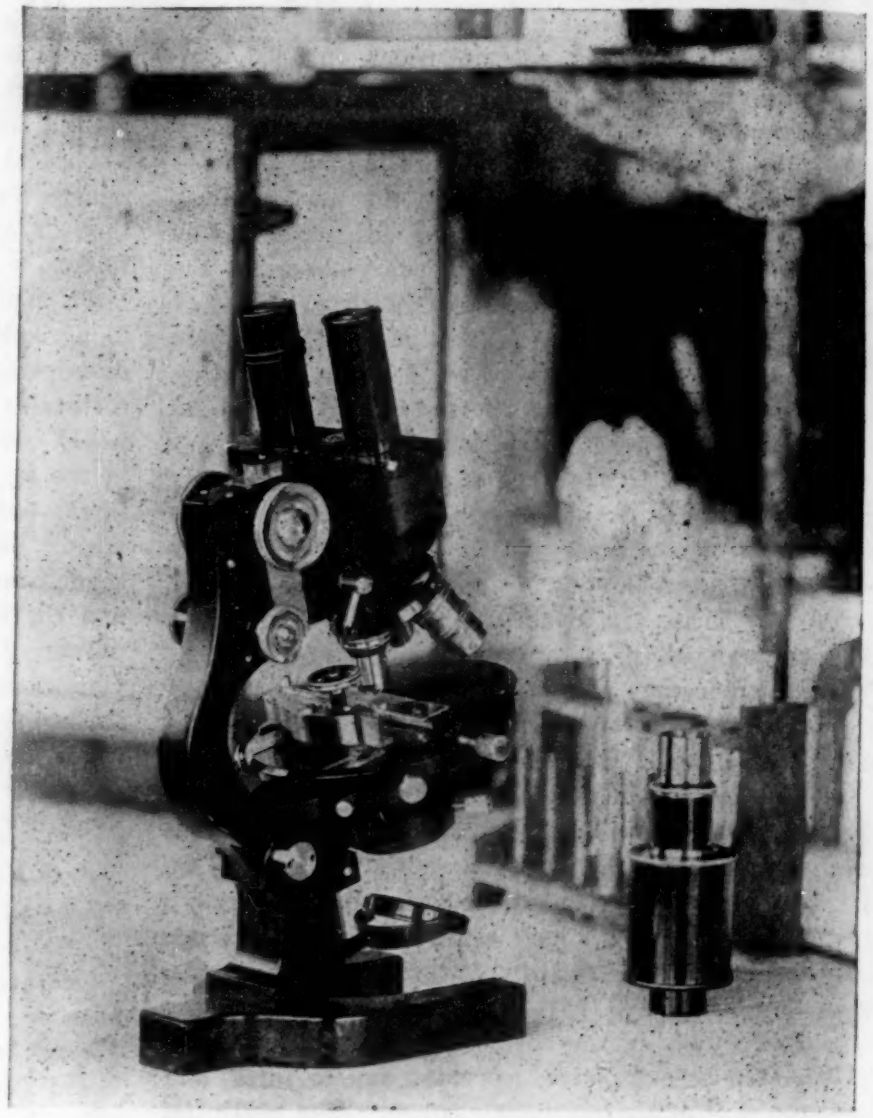

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wood; but because of the softer nature of the stalks the mechanical treatment and cooking of the new material must be less violent than in the wood-pulping processes.

THE VELOCITY OF SOUND IN LIQUIDS

A NEW way of measuring the physical properties of liquids by measuring how fast sound travels in them was described at the meeting of the American Chemical Society by Egbert B. Freyer, of the Franklin Institute, Philadelphia. The method makes use of a vibrating crystal of quartz. The physicist calls it a piezo-electric crystal, and it is also used by broadcasting stations to keep their wave-length at the position assigned to them.

The particular form of the apparatus used by Dr. Freyer is called the sonic interferometer, and was developed by Professor J. C. Hubbard, of Johns Hopkins University, and Alfred L. Loomis, at the latter's private laboratory at Tuxedo Park, N. Y. Dr. Freyer's work was in collaboration with Professor Hubbard and Donald H. Andrews.

At the bottom of a cylinder containing the liquid to be studied is the quartz crystal. Above and beneath it are electrodes, connected with a rapidly oscillating electric circuit from radio vacuum tubes. Vibrations similar to sound waves, though much too frequent to hear, are produced. These travel up to the top of the liquid and are reflected back. At intervals in the liquid are produced points called nodes that can be detected with a vertically moving piston. The distance between these nodes permits the experimenter to determine how fast sound travels through the liquid, though with a much higher precision than with ordinary methods. Knowing the velocity of the sound, the scientist can calculate the liquid's compressibility, as well as other important properties.

DISCOLORATION OF GASOLINE

DISCOLORATION in commercial motor gasoline does not necessarily mean poor quality, according to R. E. Wilson, research chemist of the Standard Oil Company of Indiana, speaking at the American Chemical Society Institute. Brown tints in the fuel, often plainly apparent to the customer served from modern glass dispensing apparatus, have no relation to possible damage which a fuel might do to a motor. On the contrary some very corrosive, low-grade gasolines are sparkling, "water-white" liquids.

Emphatic protest was voiced by Dr. Wilson against various obsolete tests and specifications which uninformed purchasers often demand of the oil companies, both on gasoline and lubricating oil. These demands, based on old-fashioned petroleum practice of a generation ago, are unreasonable, applied to the new modified motor products.

Specific gravity, once a critical measure of gasoline quality, now has almost nothing to do with merits in automotive use. In spite of this fact one state still demands a certain specific gravity test for gasoline sold in its territory, probably to the actual disadvantage of retail customers. Odor and color tests are equally wide of the mark.

With lubricating oils flash-point, boiling-point, and various other tests have also grown obsolete, but customers continue to demand goods up to the so-called standard. Frequently the fault lies with a shrewd salesman for a company which happens to have a reasonably good oil with some one particular high test. Much publicity is given to the numerical figures of this test. The test itself has nothing to do with the merits of the oil, but it does keep customers from wandering to other producers, none of whom happens to be able to meet it.

Large purchasers of petroleum products are urged to cooperate with competent chemists, now established with all reputable refiners, in an appraisal of the real merits of gasoline and oils on a modern basis, rather than to hold up a producer to unreasonable and useless tests.

ITEMS

REMAINS of dinosaurs have been brought back to the U. S. National Museum by Dr. Charles Gilmore, staff paleontologist, who has returned from a season's work in northern Montana, in the heart of the great happy hunting grounds for dinosaur remains which stretches all the way from Texas far up into Canada. Dr. Gilmore's finds include one specimen which may turn out to be a species new to science, and another which is the second of its kind ever to be discovered. The total weight of the fossils brought in runs between two and three tons. Represented among the remains are dinosaurs of the armored, flesh-eating and duck-billed varieties.

THE unlocking of vast stores of atomic energy must remain a twentieth-century alchemists' dream for a while, if results of researches at the Physico-Technical Institute of Germany are substantiated. It requires too much bombardment to crack an atom. According to quantitative measurements made at the institute, the demolition of a single atom of aluminum or magnesium requires on an average one million alpha particles, or free electrons. For the destruction of one boron atom 100,000 alpha particles suffice.

GAS for fuel and illuminating purposes can be made satisfactorily from lignite, recent experiments at Marburg on the Drau in Styria indicate. This work is being watched with much interest by Austrian engineers and industrialists, because up to the present Austria has had to import high-grade anthracite for its gas-works.

A GERMAN scientist, Dr. F. M. Litterschied, has recently found that valuable information can be gained by examining milks by ultra-violet light. In this way he can decide whether dirt in milk is due to external contamination or to the milk itself. When coated with Japan lacquer, the vegetable residues from cow's excreta give a bright red luminescence which serves to distinguish them from the ordinary milk residues (casein or albumin curd), for the latter are not affected by the lacquer. Dr. Litterschied considers that his method will prove to be of great value in the routine examination of milk.

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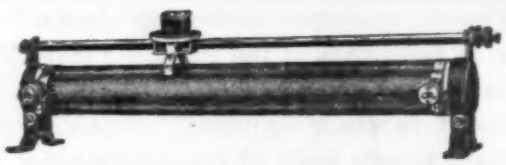

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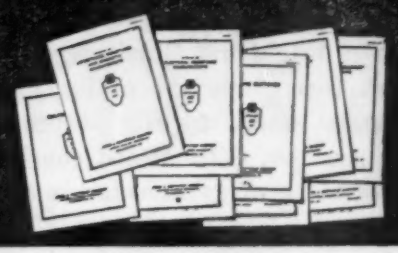

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THE MERRILL AIRPLANE

A NEW airplane that differs radically from previous models, that completely eliminates the possibility of stalling—the constant fear of the pilot of the ordinary plane—and that is as easy to control as an automobile, is one of the first products of the newly-organized Daniel Guggenheim School of Aeronautics at the California Institute of Technology. It is being demonstrated at the air meet now in progress at Los Angeles, and has there proved a sensation.

The new plane was the original idea of Albert A. Merrill, who is not a professional airplane builder, although he has been connected with experimental aeronautics since his original association with Octave Chanute in 1891. Though he was told long ago that his idea was worthless, he persevered for more than 15 years, finally to prove its validity.

What first strikes one who sees the plane for the first time is its short, stubby tail, which extends only for about four feet back of the rear cockpit. There is no stabilizer, though there is a large vertical rudder. The wings are staggered, that is, the front of the lower wing is under the middle of the top one. There is a four-degree positive decalage, as the aeronautic engineer calls it. This simply means that if the lower wing is horizontal, the upper one slants forward and upward at an angle of four degrees.

But most novel about the wings is the fact that they are not rigidly fastened to the fuselage. The two wings are fastened rigidly together, and pivoted to the fuselage about the rear spar of the upper wing. The result of this design is that the wings are stable in themselves, and not dependent upon the tail surfaces, as in the ordinary plane.

The angle of the wings with the fuselage is controlled by a crank handle by the pilot's side, connected to the wings by a sprocket and chain. This takes the place of the elevator of the ordinary plane. When the pilot wishes to ascend, he merely sets the wings at an angle and forgets about them until he is high enough, then he sets them level, and continues horizontally. If the engine stops, or if the pilot deliberately shuts off the power, the ship glides down along a slant line, but is always horizontal. Under such circumstances the ordinary airplane might stall and go into a tailspin, probably with disastrous results.

Associated with Mr. Merrill in the building of the plane was Dr. A. L. Klein, who did most of the fitting design, and Dr. Clark Millikan, who was responsible for the aerodynamic and primary structure design.

"The ordinary airplane is like an automobile that couldn't be steered if it were running slowly," said Dr. Millikan. "With the Merrill plane, however, longitudinal, or up and down, control is possible even at the lowest speeds. The control of the angle of attack, which is the angle at which the wings meet the wind, is independent of the air speed. As the pilot can always tell the angle of the wings, he can tell at once whether he is ascending or descending. A sudden gust of air, which would throw the ordinary plane out of line and require a quick manipulation of the elevator to prevent trouble, merely lifts the entire plane without disturbing its horizontal position. Even with a heavy load in back, the stability of the ship is unaffected. These advantages might be summarized by saying that the pilot only has to control his movement in two directions—to one side or the other—instead of in three, which includes up and down as well. Only in the smoothest air, which is an exceptional condition, can this be said of the ordinary plane.

"The Merrill design also permits landing in a much shorter space than ordinarily, perhaps as short as 40 feet, as compared with the usual 200 feet or so. The take-off, however, requires as long a run as the usual type.

"For the previous model of the Merrill plane a glider was used, to which a small engine was later added. Then we built the present plane. At first this had a 80 horse-power engine, with which it was flown by an experienced pilot, who pronounced it far easier to handle than any plane he had ever flown. We have just installed a 100 horse-power engine for use in the demonstration at Los Angeles."

THE FIRST INHABITANTS OF AMERICA

THE real discovery of America, by primitive men who long ago crossed the icy waters of Bering Strait from Siberia, was probably not looked upon as any great adventure at all. It was almost as simple and natural a step as crossing New York harbor might be, Dr. Aleš Hrdlička, anthropologist of the Smithsonian Institution, told the International Congress of Americanists, meeting in New York on September 18.

This problem of why and how the first human beings came into America has long been a great point of controversy, but Dr. Hrdlička stated that new evidence has accumulated in such quantities that conclusions can at last be drawn with reasonable certainty. An official report on many hundreds of skulls, a large part of which were collected personally by Dr. Hrdlička in western and Arctic Alaska recently, will soon be issued.

"There could have been, it is now certain, no great single wave of the immigrants that became the first Americans," he said. "Instead, there was a steady and natural passing over of small groups of people, and this process lasted until recent times. Siberia is an inhospitable region, where famine and cold always threaten. Less than thirty miles across, the people who wandered or were forced by others into northeast Siberia could see signs of a more pleasing shore, freer of snow and ice. The winds from that direction were warmer. Driftwood floated from that side. There were islands which served

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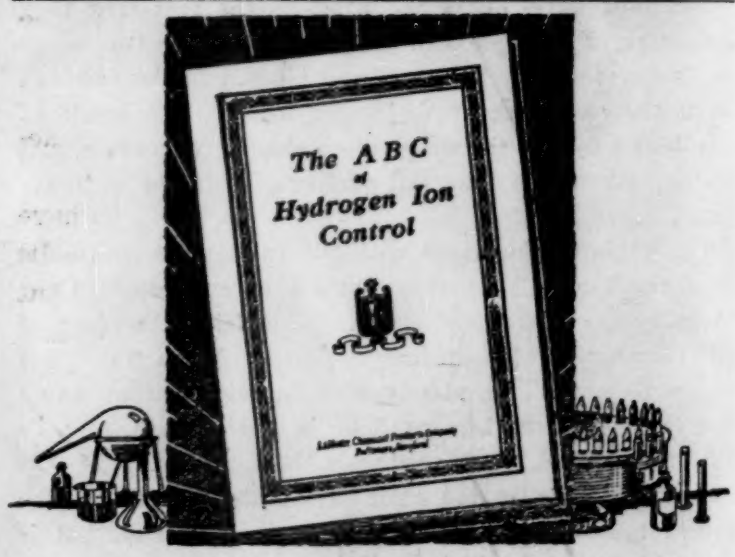

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as stepping stones, and it was easy in suitable weather for skin boats to carry groups of these Asiatics safely across the northwest passage.

"They did not necessarily stop in Alaska, or stop for a long time, but mostly in all probability, kept on down the coast, looking for warmer and pleasanter places ahead, and so the new world was gradually populated.

"Northeasternmost parts of Asia presented the only feasible route into America for the original inhabitants in their state of culture. The Asiatic ancestry of the Indian and Eskimo is demonstrated by much evidence obtained recently from old burials."

There are now more than thirteen thousand skulls in the Smithsonian collection, most of them American. Study of this vast material shows that the Eskimo and Indian are related, like two fingers that extend from one hand, Dr. Hrdlička said, and he pointed out that many typical Indian as well as Eskimo faces bear a striking resemblance to Mongoloid tribesmen of the Siberian wilderness to-day.

"The population of America has been established in the course of only a few thousand years, probably no more than 5,000," he concluded. "It would be a fine thing for anthropologists to find evidence of ancient man in this country, but no human bones indicating such antiquity have ever been discovered. Considering the large number of skilled observers who have been searching for clues to prehistoric life in this country it would seem likely that some ancient skeletal remains or other indisputable evidence of ancient man would have appeared by this time if there were any here.

"Another important point which now can be demonstrated through collections made during the last few years is that the people coming over the Bering Straits and Sea were not crude barbarians, but were bringing with them a rich and highly developed culture, exceeding that of the Eskimo or Alaska Indian of the present time. This suggests strongly that the origin of the native cultures on this continent, just as the diversification of languages, may not have been wholly evolved on American soil, as was hitherto believed."

MEXICAN POTTERY

MENTAL traits of prehistoric Indian races of Mexico, as revealed by their pottery remains, were described at the session of the International Congress of Americanists, by Eduardo Noguera, of the Direction of Archeology of the Mexican Ministry of Education.

Mr. Noguera has made a statistical study of nearly 6,000 pottery samples in Mexican museums, including the art of the potters of the Zapotec, Mixtec, Tarascan, Toltec and Aztec races. This is the first study of its kind made on these civilizations.

The Indians were an intensely religious people, and their art of pottery making, which they carried to a high point of perfection, reflects their mental traits, the archeologist said. The comparative frequency of human, animal, plant, objective and geometrical motives shows the relative importance to the ancient race of the various creatures or things they represent, Mr. Noguera believes.

The pottery of the Zapotecs, of Oaxaca, a race that apparently had certain connections with the Mayas farther south and the Mexican races to the north, shows that the human figure was more important to them than any other form used as a decorative motive, suggesting that the race had left behind the totemic stage of culture and enjoyed the philosophic consolation of believing that the human being was the most important creature on earth.

In the cases of the pottery of the other races here studied, geometrical motives were more important than human ones in determining the shapes and decorations of their pots and idols and other clay objects. Human motives were much more common than animal, while plant motives were rare. Many of the geometrical symbols used on the pottery may, however, be conventionalizations of original natural forms that have lost all semblance to what they once were, he explained. This is true in the conventionalized snakes so well known in Mexican art, whose evolution can be traced from a realistic representation to a purely geometrical form.

ITEMS

A SHARP earthquake, severe enough to be recorded on seismographs throughout North America, occurred at 7:36 A. M., eastern standard time, on Tuesday, September 11, in the Pacific Ocean about 370 miles off the coast of southern Oregon. This announcement was made by the U. S. Coast and Geodetic Survey as a result of the study of data gathered by Science Service. The exact location of the quake, said the experts of the survey, was at 42.0 degrees north latitude and 131.9 degrees west longitude. Reports of the quake were received from seismograph stations at Georgetown University, Washington; the U. S. Bureau of Standards, Washington; Loyola University, New Orleans; Regis College, Denver; University of Michigan, Ann Arbor, Mich.; the Coast and Geodetic Survey at Chicago, and Tucson, Ariz., and the Meteorological Observatory at Victoria, B. C.

LIME in salty water will prevent the corrosion of iron or steel structures that may be exposed to it, H. O. Forrest, J. K. Roberts and B. E. Roetheli, of the Massachusetts Institute of Technology, have found. Where there are bicarbonates, or salts containing the metal calcium, in the water, the lime causes a layer of protective scales of calcium carbonate on the iron. Where there is magnesium in the water, soda ash must also be added. The formation of the protective scale is hastened if the water is made somewhat acid.

PLANTS no less than people can get a browned epidermis by exposure to ultra-violet rays. The effects of these invisible rays on plants have been investigated by a committee of British botanists, which has reported through its secretary, Dr. E. M. Delf. Exposure to the glare of a quartz mercury vapor arc, Dr. Delf stated, caused browning on the plants' skin, which on microscopic examination was found to be associated with a breakdown of the outer layers of cells. The investigations are being continued this year.

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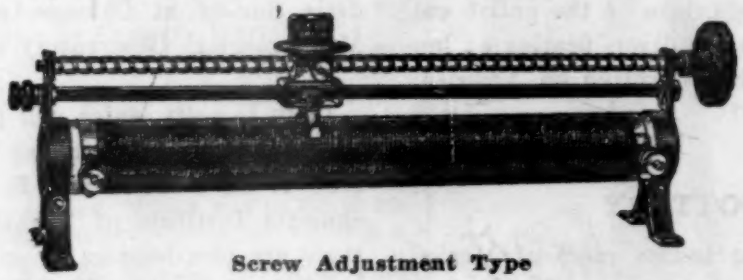

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SCIENCE NEWS

Science Service, Washington, D. C.

THE AMERICAN CHEMICAL SOCIETY

By Dr. Edwin E. Slosson

Director of Science Service

The largest association of scientific investigators in the world, the American Chemical Society, opened its general meetings at Swampscott on September 11 for the discussion of reports of progress in the study of questions of practical importance to every person in the country. Such problems as the promotion of the prosperity of the farmer, the proper employment of water power, the utilization of oil, the production of fertilizers, the expansion of foreign commerce, the development of manufactures, the improvement of health, the maintenance of the food supply and the defense of the economic independence of the United States in such vital matters as rubber, nitrates, paper, clothing, medicines and dyestuffs are more likely to be settled by the researches of scientific societies like this than by political platforms or public discussions.

For instance, cellulose now provides both literature and lingerie. If then the Division of Cellulose Chemistry can show how to get this material from straw, corn-stalks and sawdust, it will convert one of our wastes into wealth. So, too, if the chemist can convert the waste nitrogen of the air into ammonia and nitrates cheaper than can be done at Muscle Shoals it will remove another vexed question from the political arena. This meeting of the American Chemical Society at Swampscott marked the end of the first century of synthetic chemistry and the opening of a new epoch which seems likely to effect even more startling changes in business and daily life by the substitution of artificial for natural products. Three addresses at the opening session on Tuesday morning were devoted to the commemoration of a discovery made by a young German chemist in 1828 and to the consideration of its remarkable results. The speakers were Professor W. H. Warren, of Clark University; Arthur D. Little, of Boston, and Jocelyn Thorpe, of the Imperial College of Science and Technology, London. The discoverer was Friedrich Wöhler, of the University of Göttingen, then only twenty-eight years old. What he made was of no value to anybody for it was a waste product of all animals, urea. But the fact that he was able to make it in the laboratory from mineral materials overthrew the doctrine hitherto held that the chemist could never expect to compete with nature in the production of compounds of carbon. Urea is a white, odorless, crystalline substance, looking like salt or sugar and tasting somewhat like niter. It is now made by the ton from coal, water and air, and is extensively employed as a plant food in Germany on fields and pastures where it is said to double the yield of crops or milk. In the hundred years since Wöhler showed that the way was not barred to the manufacture of the products of animal and vegetable life, the chemist has made hundreds of thousands of compounds of carbon, such as dyes and drugs, foods and flavors, some of them the same as found in nature, some of them better for our purposes. A glance at the program of the meetings of the American Chemical Society shows that new achievements in this field of synthetic chemistry are being made. On Tuesday afternoon A. Lincoln Marshall, of the General Electric, and Arthur Knudson, of Albany Medical College, spoke on the formation of Vitamin D by artificial light. This would have sounded like an absurdity a few years ago, for Vitamin D was given to children to prevent rickets in the form of cod-liver oil. But now we know the mother substance of this vitamin and how to make it active by light waves of a certain sort. Another new field that the chemist is beginning to invade is that of disease. On Wednesday Dr. Ellice McDonald, of the University of Pennsylvania, talked on the chemistry of cancer, and Dr. Arthur Stull, of the New York State Board of Health, on the chemistry of pneumonia. Professor R. J. Anderson, of Yale, has been analyzing the wax coating with which the tuberculosis germ protects itself against our efforts to destroy it.

How coal and petroleum and natural gas may serve as sources of alcohols was one of the practical questions discussed at the meeting. This does not imply that the chemists disclosed any simpler or cheaper method for the manufacture of that alcohol which is prohibited for sale as a beverage by the Volstead Act for they were concerned with other and more useful members of the numerous alcohol family, such as those used as solvents in the lacquers which have recently risen in popularity. In 1927 about twenty-five million gallons of these lacquers were manufactured in this country. This is more than ten times the amount produced five years before. They have largely replaced paint and varnish for finishing automobiles and are rapidly invading other fields. They bear different trade names but consist essentially of dissolved cellulose, made by treating cotton or woody stuff with nitric acid and then dissolving it in various alcoholic and ethereal liquids. The preparation of the necessary solvents by the distillation of wood and the fermentation of corn has promoted new industries, but these are now threatened by the possibility of making them cheaper from fossil fuel. Arthur D. Little, of Cambridge, Mass., announced the results of the new method of breaking up petroleum as carried on a large scale in the plant at Tiverton, R. I. One barrel of gas oil gives 46 per cent. of motor fuel, five gallons of the higher alcohols and 800 cubic feet of useful gas, of which a fourth consisted of ethylene. This gas has recently been found to be a valuable anesthetic and also is extensively used for ripening fruit. "One cubic foot of ethylene a day introduced into a room of 5,000 cubic feet capacity will bring oranges to that golden color which nature re-

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Chemical and physiological assays are necessary to standardize finished products. The manufacture of antitoxins, vaccines and biologicals used in medical practice require the knowledge and skill of those trained in chemical, physiological and bacteriological sciences.

In addition to maintaining a staff for scientific supervision of manufacturing processes, years ago we saw the necessity of organizing a research department for the improvement of established preparations and the development of new medical products. The building pictured above is devoted entirely to scientific work.

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quires weeks to develop. Lemons picked grass green and carefully cured with ethylene will taste better, ship better and outsell lemons ripened on the tree. Tomatoes, celery, bananas and other fruits lend themselves to similar treatment to advantage, and we may even look forward to a time when melons will look more like melons and taste less like squash.'' Ethylene may also prove an aid to agriculture in another way, for certain of its derivatives are found to have the useful knack of speeding up plant growth. Seed potatoes so treated sprout nearly two months earlier than otherwise, and in many localities this makes it possible to grow two crops a year instead of one. Dr. Little hinted at a still more revolutionary change in agriculture in the possible replacement of beef cattle by the yeast plant. ''Whereas it requires about 100 pounds of foodstuffs to produce three pounds of beef and three acres of land to support a cow, thousands of pounds of solid yeast protein can be developed and separated in a few hours in a very limited space from molasses and many other wastes containing fermentable sugars.'' That the yeast plant may be given more duties to perform in the near future than making bread and beer is evident from other papers read before the American Chemical Society. Dr. Charles E. Bills told of the preparation from yeast of a white crystalline compound called ''ergosterol,'' which is one of the new hard words that the public will have to learn some time although it is so far unfamiliar even to chemists and they are not yet agreed on its pronunciation. The British chemists at present accent it on the third syllable and the American on the second. But the newcomer is important, whatever they call it, for it can be converted by the rays of the sun or mercury arc lamp into Vitamin D, which keeps babies from growing up with bow legs and poor teeth. This is the first of the vitamins to be made artificially and is so pure and potent that the addition of one part in a billion of the food will prevent rickets.

INTOXICATION by water was the topic discussed by Dr. Oliver Kamm, of Detroit. Whether water is a harmless beverage depends upon the amount imbibed and the cellular constitution of the imbiber. The four glasses a day recommended by one of the insurance companies which has taken on the task of protecting the people's health may be too heavy drinking for a few individuals, while others may drink several gallons of water a day without slaking their abnormal thirst. Dr. Kamm has found that the amount of water demanded is dependent upon the activity of the posterior portion of the pituitary gland at the base of the brain. This little organ secretes two kinds of hormones, or regulators of the human system, so much alike that they have been called ''the pituitary twins,'' but have recently been separated and are now employed in medicine for different purposes. They are distinguished as A and B, or on account of the traditional fondness of scientists for Greek, as alpha and beta. The beta secretion regulates the water supply. The portly person who persists in putting on weight in spite of cutting down his diet and drink may be suffering from an excessively active pituitary gland or from the undue sensitivity of his tissues to the secretion. He is called ''fat'' by his friends or his enemies, but he may be merely water-logged. On the other hand, the scrawny man, who remains lean however much food and water he takes, may have the opposite defect of pituitary action and may be suffering from desiccation. This same beta hormone aids the frog in changing his skin color to suit his surroundings as a kind of camouflage. A frog in his light-colored costume turns dark on being treated with a minute dose of the hormone, because this expands the black cells in his skin. Dr. Kamm suggests that this secretion may serve to save life in the case of extensive body burns since the danger here is from the undue drying of the tissues. The menace to public health from the common use of arsenic in spraying fruit trees, vegetables and tobacco to ward off insect enemies was emphasized by Dr. C. N. Myers, of Brooklyn. Fruit is often insufficiently washed and tobacco leaves are impossible to wash free of the poison. Celery and lettuce are sometimes dangerous because inadequately cleansed. A single apple has been found to carry a full medicinal dose. Since arsenic accumulates in the system even minute doses may become injurious if frequently repeated. How to make mayonnaise to suit lean ladies was one of the questions discussed in the food section of the American Chemical Society. It seems that a new sort of salad dressing has been invented which contains only 30 calories of fattening food per helping instead of 120 as in the old-fashioned recipe. Other questions considered in this food industries symposium were how to get vitamins into margarine and breakfast foods, how to get holes of the proper size in Swiss cheese, how to make the advertiser of breakfast foods stick to the truth as the chemist sees it, and how to utilize the millions of pounds of skim milk and whey now wasted every year. Dr. G. E. Holm, of the U. S. Department of Agriculture, called attention to the saving effected by the new method of transportation of milk in bulk by glass-lined tank cars, but pointed out that shipping dry milk would be still more economical, for it never pays to transport water.

A NEW and apparently profitable employment for natural gas was pointed out by T. E. Layng and R. Soukup. Experiments being carried out at the State University of Illinois have shown that methane can be easily and quickly and presumably cheaply converted into formaldehyde. Now the raw material, methane, is the chief constituent of natural gas, which runs to waste in some parts of our country as we may see by the flaring torches burning all night in localities needing no illumination. And the product, formaldehyde, is familiar to all of us under the name of ''formalin,'' since it is in common use as a disinfectant. It is equally common, although not so familiar, as one of the two constituents of bakelite used in radio receivers, phonograph records and automobiles. The other component of this synthetic plastic is the well-known disinfectant carbolic acid, obtained from coal-tar. The Illinois investigators get as high as 30 per cent. of the methane transformed by a single passage of the gas, together with oxygen, through

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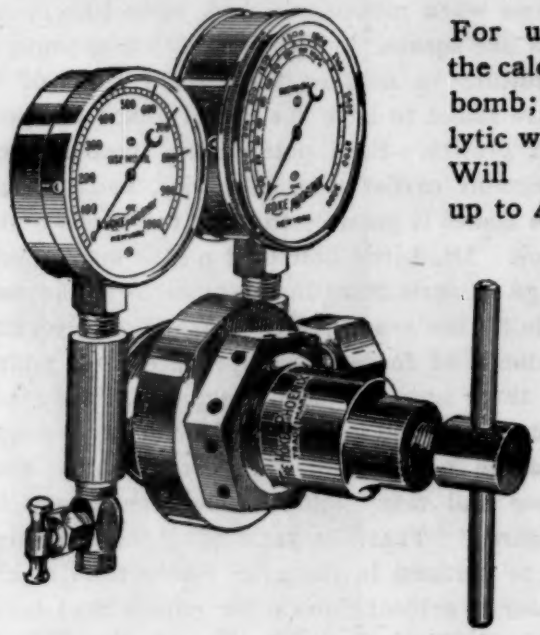

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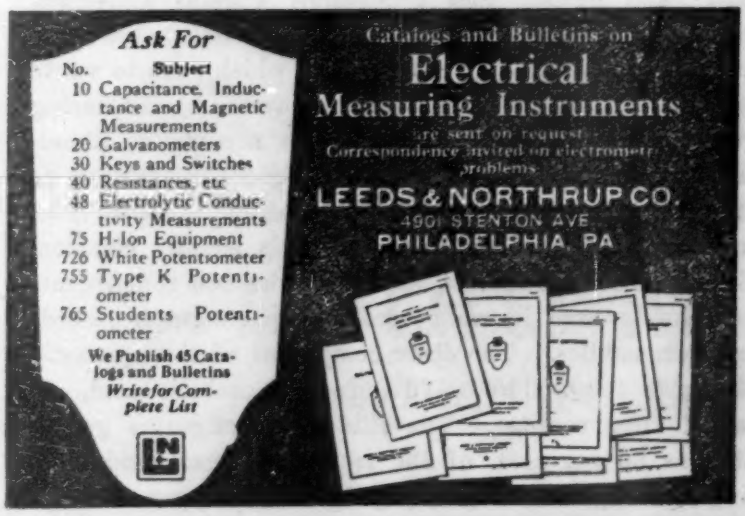

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a small glass tube heated to a temperature of 690 degrees centigrade and without the need of the high pressure that previous investigators have been obliged to employ. The secret of their success is the use as the catalyst, or combining agent, of a small amount of one of the oxides of nitrogen, the red fumes familiar to every beginner in chemistry. Other compounds produced from natural gas are formic acid and methanol and it seems feasible to direct the process so as to form these and other useful products in predominant proportions. Methanol, commonly called "wood alcohol," is employed as a denaturant to render alcohol unfit to drink and some of our citizens have found to their sorrow that it is not the same thing as grain alcohol. It used to be made by the distillation of wood, but a few years ago German chemists found out a way of making it from coal and have since been exporting it to America. But if it can be made still cheaper from natural gas we may regain the native industry. The chemical industries suffer from the rapid progress of chemical science. At the nitrogen symposium almost all the speakers took occasion to point out that the plants built during the war for the fixation of atmospheric nitrogen for explosives, like that at Muscle Shoals, were obsolete and incapable of competing with processes invented since. In the early and antiquated methods, meaning those of ten years ago, the chief requisite was cheap power. Now cheap hydrogen is more sought. Jasper E. Crane, of the plant at Lazote, West Virginia, says: "It is natural that so many nations of the world now aim to become self-contained with respect to nitrogen; the instincts of self-preservation both as regards self-defense and food supply prompt that desire. Yet this is bringing into being nitrogen projects that are economically unsound. For instance a plant which has enough to supply only the military nitrogen requirements of a country will be too small to work economically and to lend any contribution to the needs of agriculture. To bolster up such a project by governmental subsidy wastes public funds and prejudices private enterprise." H. R. Bates, of International Agricultural Corporation, reported that the world's consumption of inorganic nitrogen for the year ending June 30, 1928, was 1,600,000 metric tons, more than twice what was used in 1913. Of this output nearly a million tons are now extracted from the air factories. The rest is about evenly divided between the nitrogen obtained from the nitrate beds of Chile and that coming as a by-product of coke ovens. It is a curious situation, and fortunate for us, that there are three independent sources in competition to supply the soldier and the farmer and family refrigerator with the nitrogen they need—a mineral deposit, a continuous industry and the fixed nitrogen factory that can be expanded at will.

ITEMS

THE advisability of a general X-ray chest survey of U. S. Army recruits was discussed by Dr. Charles L. Maxwell, of Washington, D. C., at the meeting of the American Roentgen Ray Society at Kansas City on September 28. The discussion was based on an analysis of the latest fifty cases of pulmonary tuberculosis admitted to Fitzsimons General Hospital, Denver, in recruits of the U. S. Army with less than one year's service at the time diagnoses of tuberculosis were made. At the same session Dr. Ralph A. Kinsella, of St. Louis, outlined a plan for having X-ray pictures made of the chests of all patients admitted to the medical service of hospitals. The cost of hospital and patient, objections to the plan and beneficial results, such as discovering unsuspected cases of tuberculosis, were discussed by Dr. Kinsella and Dr. L. R. Sante, of St. Louis.

X-RAYS that are helping surgeon and physician to-day may tomorrow be helping psychiatrist and judge, prophesied Dr. M. J. Hubney, of Chicago, at the meeting of the American Roentgen Ray Society. The mental twist or aberration that makes a man behave in such a way that we call him insane or criminal may be due to abnormal structure or development of his brain. The X-ray has a big future in helping to detect these abnormal anatomical conditions and to connect them with abnormal functioning and unsocial behavior. Treatment of the insane and punishment of criminals will be much more effective when based on accurate knowledge of the physiological causes of crime or insanity.

A MOVING picture of living tissues, which shows just what happens to the cells of the body and to cancer cells when radium is applied, was the feature at the meeting of the American Roentgen Ray Society. The film, shown by Dr. A. H. Pirie, of Montreal, president of the society, was made by Dr. H. G. Canti, of London. In addition, films from the International Radiological Congress, at Stockholm, taken by Dr. T. Leucutia, of Detroit, were shown.

THE asphalt pits at the Rancho la Brea at Los Angeles, once filled with the skeletons of a score of species of mammals long since extinct, were for thousands of years constantly a slightly mobile and shifting mass. Huge bubbles of gas, slowly working their way upward through the mass of bones, tar, sand, dirt and trash, caused slight, discontinuous movements which by the contact of bone on bone or bone on teeth, produced great changes in the skeletal parts which is known to museum workers as "pit wear." Nowhere else in the world has such a phenomenon been known. Large, strong limb bones have been cut smoothly in two parts; teeth are curiously worn; skulls queerly scratched and abraded and thousands of skeletal parts worn into curious forms.

THE skeleton of a 5,000-year-old Greenland whale has been found at Kistinge, Sweden, by workmen digging a ditch near the seashore. A jaw-bone, measuring about 13 feet in length, has already been unearthed. On account of its size, it was first taken by the workmen to be a part of the hull of an ancient vessel. The bone has been examined by archeologists, who estimate the whale to have lived at the end of the ice age, about 5,000 years ago.

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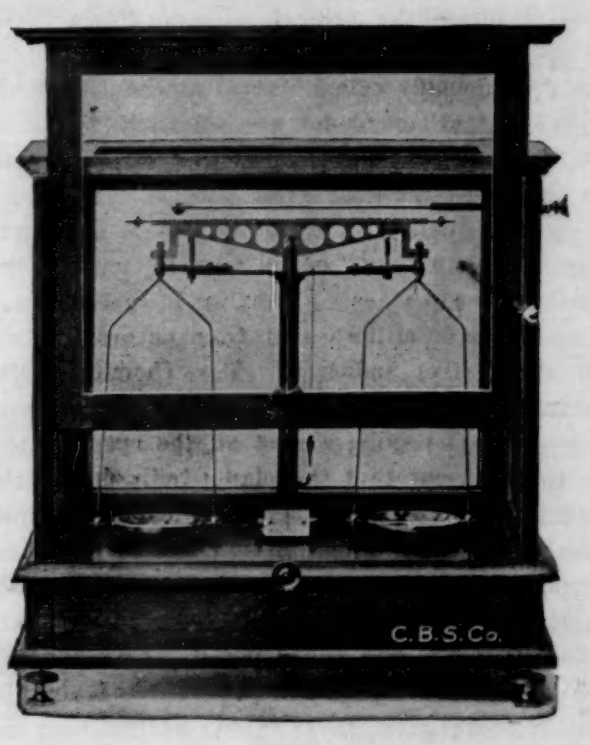

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SCIENCE NEWS

Science Service, Washington, D. C.

SCIENTIFIC CRUISE OF SUBMARINE AND NAVAL BOATS

USING a submarine to weigh the earth's crust instead of to sink ships is the task about to be undertaken by the U. S. Navy Department, in cooperation with the Carnegie Institution of Washington. On Tuesday afternoon, October 2, there sails from the Navy Yard the submarine S-21, accompanied by two eagle boats, on one of the most novel cruises ever undertaken—a cruise reminiscent of Jules Verne or Conan Doyle.

The submarine will be a floating gravity observatory. By means of an instrument invented by a Dutch scientist, Dr. F. A. Venning Meinesz, of the Geodetic Commission of Holland, measurements of the force of gravity can be made at sea for the first time. So important are these observations that Dr. Meinesz was invited to the United States by the Carnegie Institution. The Navy Department has now given him the use of the eagle boats and submarine for a period of several months. During this time they will cruise around the region of the Gulf of Mexico and the Caribbean Sea. Assisting Dr. Meinesz are Dr. Fred E. Wright, of the Carnegie Institution's Geophysical Laboratory, and Elmer Collins, of the Hydrographic Office of the Navy.

In order to know the exact shape of the earth, scientists must know the force of gravity, and the only way of measuring this is by accurately timing the swings of a pendulum. Such measurements have been made on land for many years, but since the largest part of the earth's surface is covered with ocean, it left a large unknown area. The motion of the ship made pendulum observations impossible at sea.

Dr. Meinesz decided to make use of a submerged submarine, which is much more steady than a ship on the surface. But his improved apparatus is so successful that he now believes it possible to use it on a ship on the surface in still water and with the engines stopped to prevent vibration. Instead of using a single pendulum, he uses three, arranged as two pairs. They all have the same period, but are swung somewhat out of step. Tiny mirrors attached to them reflect a beam of light back and forth as the pendulum moves. Unlike an ordinary pendulum, however, the light goes from one pendulum to the one next to it and then back to a moving strip of photographic paper, on which a record is made as a wavy line. Though the motion of the ship affects each pendulum, and each would give a very irregular record if recorded separately, the combination of the two results in a record like that of a single, steady pendulum. The apparatus was tried on a Dutch submarine, in which two trips were made from Holland to Java, one by way of the Suez Canal, the other by way of Panama.

The importance of these observations is that they afford an indirect method of weighing blocks of the earth's crust, said Dr. William Bowie, of the U. S. Coast and Geodetic Survey. Then, if it is found that the weight under water is the same as that of the crust under the land, it means that the density of the block of the crust under the ocean is greater, and that this part of the earth is in what the geophysicist calls "isostatic equilibrium." This gives a better and more accurate idea of the exact figure of the earth, and so provides data of fundamental importance to students of the earth. The region in which the coming cruise will be made is one of several important ocean deeps, great submarine rifts in the earth's crust. As an ocean deep is a favorite place for the occurrence of earthquakes, more exact knowledge of their characteristics may prove of special value.

Though this is the first time that this work has been done except on the Dutch submarine, Dr. Bowie hopes that it will eventually be performed by all the navies of the world. "There is plenty of room in the oceans," he said, "for everybody." He also advocates that the U. S. Navy continue the work in the future, even after the present project is completed, by permanently equipping a submarine with the apparatus. As the accuracy of the charts used by the Navy depends upon exact knowledge of the earth's figure, the work is of considerable practical value.

INSIGHT INTO THE STRUCTURE OF MATTER

A VERY recent discovery by a Hindu scientist, Professor C. V. Raman, that intense light of a single color is partly changed to other colors when it shines on various transparent substances "opens up a wholly new field in the study of molecular structure." This statement was made by Professor R. W. Wood, of the Johns Hopkins University, in announcing that he had completely verified Professor Raman's discovery in the private laboratory of Alfred L. Loomis.

According to Professor Wood, who has just completed an investigation of the subject with improved apparatus and a more powerful spectroscope than the one employed by Raman, the effect occurs when monochromatic light, which is light of a single color, and, unlike white light, is entirely of a single wave-length, shines on transparent substances such as quartz, chloroform or water. The light that is scattered from the material is mostly of the same color, or wave-length, as that of the light illuminating it. The spectroscope, the instrument that analyzes light, shows, however, that part of the light is changed to wave-lengths a little longer or a little shorter than the source. On the spectrum photographs the result is a heavy line attended on either side by narrower and fainter lines. The fainter groups of lines on one side are the same as those on the other, except that they are reversed, as if reflected in a mirror, the center line being the mirror. Professor Raman found only a single and very faint line on the high frequency side of the exciting line, but Professor Wood has found groups of lines on this side almost as strong as the groups on the other in the case of carbon tetrachloride and chloroform.

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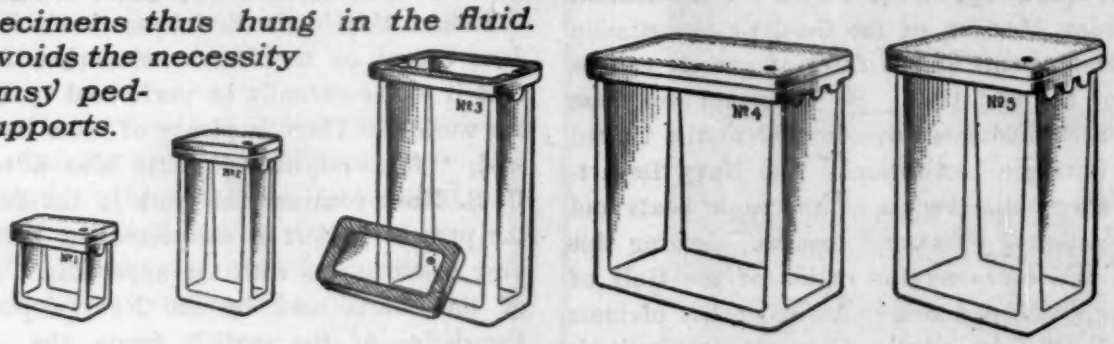

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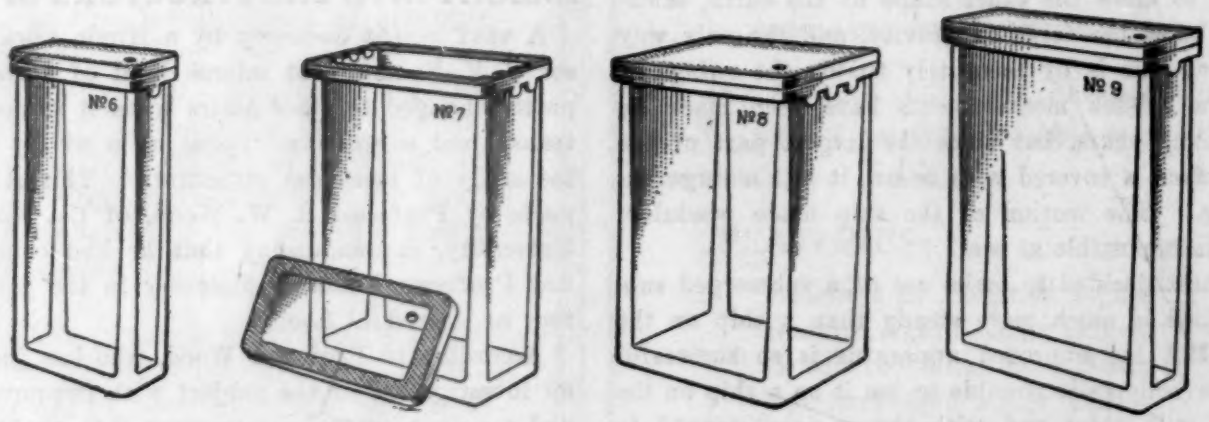

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For details and prices see pages 416-7 Fisher Catalogue. Here, also, is described a better cement for sealing Museum Jars.

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The importance of the discovery comes from the fact that the difference between the frequencies of the light given off, and those of the light which shines on the substance is precisely the same as the frequencies of the absorption bands of the same substance for infra-red light —light which is vibrating too slowly to be seen or even to be recorded on the photographic plate without great difficulty. By means of the Raman effect, the physicist can now study these bands of absorption indirectly.

Professor Wood also pointed out that the effect was one of the most convincing proofs of the quantum theory of light, which supposes that light consists of separate pulses, or "quanta," rather than waves, as was formerly supposed. Only by the quantum theory, he thinks, can the effect be explained.

Most of his research was done with crystalline quartz, or such liquids as chloroform and carbon tetrachloride, illuminated with a mercury vapor arc lamp. He is now planning to repeat the work with a spectroscope of 40-feet focus, which will give even more convincing results than those he has now obtained.

MUSCULAR ENERGY INCREASED BY PRESSURE

A STIMULATING influence of high pressures on the function of the muscles has been discovered as a result of experiments conducted by Dr. McKeen Cattell and Dr. D. J. Edwards, of the Cornell University Medical College, which are reported in *The American Journal of Physiology*. The ordinary effect of pressure on a tissue is to stop its functioning. However, when pressure is made on muscles that are completely immersed in a fluid, the muscle on contracting does more work, according to the unexpected results of these experiments.

When local pressure is applied to a muscle, injury is readily produced, due to the tissues becoming deformed and the fluid in the tissues being displaced. But when muscular tissue is completely immersed in a fluid, as it was in these experiments, the only effect of the pressure is a slight change in volume caused by the pressure acting upon a liquid system, which is what the muscle and the fluid it is immersed in form. Under these conditions it was found that the muscle was markedly stimulated to greater energy production. The investigators used pressures as great as 1,000 pounds per square inch and found that the higher the pressure, the greater the stimulation. The average tension developed by the muscle under pressure when stimulated was increased one third over the tension under ordinary air pressure. There was an increase in heat production corresponding to the tension changes when pressure was applied. No conclusion as to the practical application of the work has been reached, but it may throw interesting light on the mechanism of muscular contraction.

PRIMITIVE SKULLS AND THIGH-BONES

HAS man gone up the evolutionary ladder literally feet first? Did his legs evolve into human legs faster than his head evolved into a human head? The possibility that there has been a tendency in the human genus to evolve from the bottom up in more than the figurative sense is suggested by Dr. Wilhelm Gieseler, of the University of Munich, writing in the German scientific weekly *Forschungen und Fortschritte*.

Dr. Gieseler has made a study of the two most-disputed human or near-human remains so far discovered, the Pithecanthropus or Ape-Man of Java and the Broken Hill Man of South Africa. Both of these *n*th degree great-uncles of the human race had very primitive skulls, the cranium of Pithecanthropus especially being so "low-brow" that many anatomists are still disposed to deny it human rank at all, but to classify it instead as the skull of an extinct species of gibbon or East Indian ape.

Dr. Gieseler defends his opinion that Pithecanthropus was human, largely on the basis that his eye-sockets are man-like rather than ape-like, although he admits that the skull is so low that the doubts of some of his colleagues are easily accounted for.

But an examination of the thigh-bones of both Pithecanthropus and Broken Hill Man tells an entirely different story. Not only is the thigh-bone of Pithecanthropus quite unlike that of a gibbon, but the thigh-bones of both the extinct humans (or near-humans) are so much like those of modern man that doubts have been expressed in both instances as to whether they really belong with the skulls at all. If they do not, it is an extremely striking coincidence that *two* debatable skulls should have happened to be found with thigh-bones that did not belong with them. If they do, we have the astonishing spectacle of men, or man-like creatures, with very decidedly primitive skulls walking on leg-bones built on a decidedly modern pattern.

WILL-O'-THE-WISP

Two close-up observations of the will-o'-the-wisp, those weird and elusive flames that appear over marshy ground, have recently been put on record by German observers. H. H. Sven, a German scientist, observed one night in November, 1927, near an iron mine in Bohemia upon a swampy tract of land, four small bluish phosphorescent flames. They were of the height of a candle-flame and a diameter of about an inch and were constantly hopping up and down. Near them appeared a flame of about three feet in height of a yellowish green color and diameter of about a foot. The light of the flames was sufficient to read the face of a watch and to make notes, but they had no heat when touched. After the phenomenon had lasted 15 minutes they went out.

In the vicinity are several springs with radio-active water. Upon returning to the place in the daytime Mr. Sven could find no trace of the source of the flames. He learned, however, that while will-o'-the-wisps appear to be independent of air temperature they are dependent upon air pressure; the higher the pressure the less the light.

W. Schulze, during the war an officer in the army, describes the following. In September, 1914, his battalion was withdrawn from the front lines and had to recross the

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river Muerthe. During the afternoon artillery had also crossed. The route led through dense woods and had become almost impassible because of heavy rains. Schulze saw on both sides of the route, where a corduroy road had been attempted, pale greenish and yellowish thin flames shooting up and down from about 12 to 18 inches high. More accurate observations could not be made, but the flames were doubtless produced by the great pressure caused by the passage of artillery, combined with heat and rain. Gases apparently streamed from the moist earth and caused the flames.

HURRICANES AND TORNADOES

THOUGH the hurricane which devastated Porto Rico and the tornado that destroyed property in Rockford, Illinois, arrived a little more than a week before the autumnal equinox, neither of them can be called the "equinoctial storm." The fact is that the old idea of a severe storm occurring at the time the sun "crosses the line" is a superstition, unsubstantiated by any scientific fact.

The autumnal equinox, when the sun crosses the equator on its southward journey, and autumn commences for people in the northern hemisphere, occurred this year on September 23. Sometimes it happens on September 22, but any severe storm within a week or so of this date is apt to be called the equinoctial storm by some people. The hurricane season in the West Indies begins during the late summer and reaches its height in September, so there is almost sure to be some kind of a storm at this time.

Tropical hurricanes, such as the Porto Rican one, the one that damaged Miami in September, 1926, or the famous Galveston storm of September, 1900, originate over the Atlantic Ocean in the tropics somewhere north of the equator. Calm air, high temperature and humidity are the most favorable conditions for the formation of a hurricane, and these are most likely to be fulfilled in the "doldrums" of the North Atlantic Ocean in the late summer or early fall. Hurricanes may, however, occur at any time of the year, or in other places. They also occur in the Pacific Ocean and in the Indian Ocean. Those that occur south of the equator differ from those experineced in the West Indies and other parts of the Northern Hemisphere, because the winds in the northern hurricanes spin in a direction opposite to that of the hands of a clock, while those of the southern ones whirl clockwise.

Usually the north Atlantic hurricanes travel northwesterly until they reach the region of the westerly winds off the American coast, then they recurve to the northeast, and sometimes may not even be noticed on land. On Saturday, September 15, officials of the U. S. Weather Bureau declined to predict whether or not the Porto Rico storm would reach Florida, but stated that they expected it to be over the Bahamas on Sunday, September 16, and that strong winds at least might be expected in Florida by Sunday night.

The fact that the Rockford tornado occurred at the same time as the hurricane was a mere coincidence. About a hundred tornadoes occur a year in the United States, but most are in the period from March to October. Like the hurricanes, they are rapidly spinning whirls of air, but are much more limited in extent. They are even more vicious than the hurricanes.

ITEMS

AN unusual feature of the Dresden Hygiene Museum of 1930, which will move into its own home in a specially constructed building in 1929, will be the exhibit showing human beings and their existing conditions of life with measures by which the injurious effects of these conditions may be counteracted. On the practical side, primary importance will be given to: first, nutrition and the hygiene of food; second, the hygiene of clothing and, third, the hygiene of the dwelling. In 1930 the museum will be the center of a great exhibition which will be devoted to the advance in hygiene since 1911, when the German Hygienic Museum originated.

THE General Sherman Big Tree in the Sequoia National Park, estimated to be at least 4,000 years old, is still producing an annual crop of cones from which fall millions of fertile seeds. The park rangers have nurseries which contain many young trees, the progeny of this oldest and largest living thing. The Methuselah of the forest perpetuates its kind to-day as it did when Cheops built the Great Pyramid in Egypt.

A SIMPLE test for determining rices that will prevent beriberi in human beings and polyneuritis in pigeons and other fowl has been developed by Dr. Edward B. Vedder, of the U. S. Army Medical Corps, stationed at Manila, and R. T. Feliciano, chemist of the Manila Bureau of Science. The rice grains are stained with an iodine solution, the starch granules taking on a blue color. The proportion of external layers, which remain unstained, and which contain the beriberi-preventing factor, may be determined with reasonable accuracy by simple inspection, report these investigators. This method is so quick that it may be used during the milling process to determine the degree of milling. A chemical index for beriberi-preventing rice was also determined.

HUGE trees growing without any visible means of support are a striking feature of the great Zapata Swamp of southern Cuba. This swamp, nearly 1,800 square miles in extent, includes an area of limestone that is filled with holes and covered with a variety of tropical trees. Silk-cotton trees four feet in diameter, big mahoganies, and many other kinds are found growing on this limestone area where not so much as a single spoonful of soil could be gathered from an acre. The trees make their start in small pockets and holes in the limestone where collections of leaves and slight accumulations of disintegrated rock furnish them with cover for growth. The roots stray about over the surface of the rock in search of food, finally plunging through holes to find sustenance in soil hidden deeply in the cavernous recesses of the coral stone.

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ELECTRONIC WAVES

A THIN film of pure gold, far thinner than the thinnest gold-leaf, affords new evidence that electrons are waves, or, at least, accompanied by waves. Electrons, the building blocks of which atoms are supposed to be made, were formerly thought of as being like small particles, but modern physicists think that they more nearly resemble waves like light or even radio waves, though much shorter in length, or higher in pitch.

Professor George P. Thomson, of the University of Aberdeen, and son of Sir J. J. Thomson, one of the most eminent of present-day English physicists, has made the gold-film experiments, which he recently reported to the Royal Institution. A thin film of metal, such as he used, is a screen of molecules that permits the physicist to tell waves from particles. The arrangement of the gold molecules forms a lattice. If a stream of tiny particles is aimed at the screen, they hit molecules at a variety of angles, and so the stream emerges from the other side spread out as a cone. But waves are affected differently. When they go through such a screen they prefer to bend at certain angles. Therefore, if a photographic plate, which is darkened by the electrons, is placed a short distance back of the gold film when the electrons are passed through, a black spot will appear on the plate, surrounded by a series of concentric rings. The black spot represents the bulk of the electrons, which pass through without deviation, the rings represent those which are bent at various angles.

In performing this experiment, Professor Thomson obtained exactly this effect. Furthermore, to prove that it was not due to light, which is known to behave in a similar manner, he repeated the experiment with a magnet near by. Electrons are pulled out of their course by a magnet, while light is not. With the magnet, the rings were displaced, as they should be if the effect were due to the electrons. So it is demonstrated rather conclusively that a stream of electrons contains waves. Whether these waves are the electrons themselves, or merely accompany the real electrons, is still a speculation. However, Professor Thomson has measured their wavelength and has found that their pitch is more than a million times higher than that of visible light, far higher than that of X-rays, and, except for the cosmic rays, higher than that of any known radiation.

But Professor Thomson points out that the electron waves are not like light waves. Even if they were as low in pitch as light waves, they would not be the same. They travel at different speeds, the electron waves are bent by electric and magnetic fields, while ordinary light is not, and their penetrating powers are quite different. "If they are actual motion of an ether," he says, "it must differ in some way in the two cases."

Besides the evidence for the electronic waves afforded by the gold film experiment, similar evidence has been found by Drs. C. J. Davisson and L. H. Germer, of the Bell Telephone Laboratories in New York City. They fired a beam of electrons into a crystal, and found that it behaved in the same way as X-rays or other waves, that is, it was diffracted at several preferred angles, instead of being scattered in all directions.

DUTCH EAST INDIES EXPEDITION TO STUDY MOUNTAINS IN MAKING

A GREAT mountain system, now slowly forming under the waters of tropic seas, whose peaks and partially emerged ranges are now known as the East Indies, is to be the object of study by a Dutch scientific expedition now about to take the field.

The eastern portion of the East Indian Archipelago is a region which is probably more subject to present-day geological activity than any other area on the earth. The sea bottom between Borneo, New Guinea and the Australian shelf is different from any other, not even excluding the West Indies. It is an area of most marked unrest, studded with islands and active volcanoes, arranged in an intricate system of looped arches encircling deep basins. Coral reefs, which can only live and grow within a few feet of the surface, indicate that this entire region is subject to continuous changes of level.

These conditions make the Moluccan Archipelago a region of exceptional interest for oceanographic, biological and geologic research. The very pronounced relief of the sea-bottom and the occurrence of a number of individual deep basins, separated from the open ocean by shallower sills, cause a complicated subsurface circulation of water and anomalies as to deep-sea temperatures, chemical constitution and food supply of the water, which influence life in these deep basins in a peculiar manner. All this is of the greatest interest to the oceanographer, the zoologist and the geologist.

It is the general opinion among geologists that we are witnessing here a truly Alpine chain of mountains actually in the making: a product of the violent compression of a wide region between the continental masses of Australia (including New Guinea), and of southern Asia (including Borneo). The present sea-bottom and the topography of the islands are the surface expression of the mountain folds at the time of their formation. In the Moluccas we have now the means to observe the actual making of mountains. But, being largely submarine, we need the oceanographer to give us the accurate picture.

Physical and biological conditions in these isolated deep basins in the ocean floor, subject to active deposits of sediment from the numerous tropical islands, are very different from those in the open ocean, and of the greatest interest for the interpretation of the rocks which we find in the mountains of former geological periods, where conditions of their deposition must have been very similar.

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THE RESPIRATORY FUNCTION OF THE BLOOD. Part II Haemoglobin. Joseph Barcroft. pp. viii + 200. $5.00.

Owing to the rapid advance of knowledge, the author found it impossible to revise his original volume on *The Respiratory Function of the Blood* for a second edition. He therefore decided to break up the work into a series of manageable units. The first volume of this series, *Lessons from High Altitudes,* was published in 1925, the second is now presented.

BIBLIOGRAPHY OF SPONGES; 1551–1913. G. C. J. Vosmaer. Edited by G. P. Bidder and C. S. Vosmaer-Röell. pp. xii + 234. $5.25.

This list of titles of books and articles on sponges is as complete as possible and contains the literature on recent as well as on fossil sponges.

D. Appleton and Company, New York

GEOLOGY. Alfred Perry Brigham. Revised and expanded by Frederick A. Burt. pp. x + 554. 325 illustrations. $3.00.

The book takes into consideration the study of geology in four divisions: dynamical, structural, historical and economic, the last being an entirely new section written for this new, second edition.

McGraw-Hill Book Company, Incorporated, New York

ECONOMICS OF CONSUMPTION. Warren C. Waite. pp. xii + 263. $3.00.

In this book which has grown out of a course given for several years to students of home economics at the University of Minnesota, the economic order is viewed from the standpoint of the individual within the order, and the way in which economic forces and institutions limit and condition his consumption is shown.

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THE ENGINEER; HIS WORK AND HIS EDUCATION. Robert Lemuel Sacket. pp. vii + 196. Illustrated. $1.40.

This book is dedicated to those who are considering engineering as a life work. It offers them an opportunity to know something about engineering as a profession and about the college course which helps them to prepare for it.

Stanford University Press, Stanford University, California

CROSSROADS IN THE MIND OF MAN. Truman L. Kelley. pp. vii + 328. $4.00.

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Past oceanographic expeditions have largely confined themselves to the open ocean and have scarcely touched the East Indies. The only exception of note is the important Dutch Siboga expedition of 1899, the object of which was largely zoological. The number of existing off-shore soundings is still very small for a region with such intricate relief. This becomes very clear if we compare the area with any mountainous district on land. It would be as if the relief of the Alps in Switzerland were known from only 40 to 50 date levels.

A new oceanographic expedition in the Moluccan seas is now in preparation under Commander P. M. van Riel, chief of the oceanographic section of the Netherlands Meteorological Institute at De Bilt, near Utrecht, with the support of the home and colonial governments and several institutions and individuals. The funds have been secured to a sufficient amount to permit about 15 months of active work. The expedition is to leave early in 1929. It will use a newly launched surveying vessel of the Dutch Government, the *Willibrord Snellius*.

In addition to an extensive program of physical, chemical and biological research, particular stress will be laid on the configuration of the bottom and the sediments now being deposited there. In addition to the latest oceanographic sounding and sampling equipment and the biological outfit, the vessel will carry sonic sounding apparatus, with which it is expected to make at least 10,000 new depth determinations, in order to obtain a reliable and fairly detailed map of the submarine topography of this most interesting region.

It is planned that a submarine of the Dutch Navy will cooperate with the expedition, in order to make gravity observations at sea by the method developed by Professor Vening Meinesz.

UNDERSEA CAMERA FOR STUDYING THE TIDES

A UNIQUE motion-picture camera, recording automatically the velocity and direction of currents beneath the surface of the water, was used to advantage this past summer by the U. S. Coast and Geodetic Survey during what is stated to be the most comprehensive survey of tide and current conditions in Chesapeake Bay ever attempted.

While the device is so new that it has not yet been perfected fully, it has shown results that indicate it will be used as a regular part of standard current testing equipment. The camera is designed to take the place of a complete human observing unit composed of one boat, one officer and six men. It contains within it a compass and revolution dial of which pictures are made each half hour, and works continuously without attention for an entire week.

The purpose of the survey's probe this summer was to bring aids to navigation, such as mariner's charts and current tables, absolutely up to date. From the data gathered this year and last, current tables will be published from which at any future time the direction and velocity of currents at any place in the bay may be ascertained. The information likewise will be valuable in enabling engineers of surrounding cities to make proper disposal of their sewage. They must know at precisely what point the ebb of the tide will be able to convey the sewage farther out to sea than the flood current is able to bring it back.

Fishing interests will be aided by the data since certain fish are known to bite better at certain tidal stages than at others.

Headed by Lieutenant George L. Anderson, the survey engineers, four all told, conducted their investigations from four 65-foot launches. A unique feature was that 24 college boys, selected from leading universities in the East and mid-West, acted as special observers, their purpose being to gain technical experience to add to their engineering knowledge.

PASTURES AND THE RANGE OF INSECTS

THAT an ordinary barbed-wire fence may be almost as effective in excluding grasshoppers and other insects as it is in excluding cattle is one of the curious results obtained by Professor A. O. Weese, of the University of Oklahoma, in his recent studies of buffalo pastures in the Wichita National Forest. However, it should be added, the insects respect the fence primarily because it is cattle-proof.

The fence in question serves to separate an area of moderately grazed typical virgin prairie from an area of grassland which has been seriously overgrazed. Botanists have known for some time that overgrazing of native pastures tends to throw the balance of vegetation towards a drier type than normal. That is, a pasture in the moist region of tall-grass prairie near the Mississippi will be converted by excessive grazing into a pasture composed of plants usually found much farther west, in the region known as the short-grass plains. Thus a straight fence-line will often be found separating groups of plants which ordinarily would be found separated by long distances in nature.

Professor Weese and his students have been sweeping two such adjacent types of grassland with their nets and identifying the insects caught. In doing this they have discovered that the associations of insects are quite as rigidly distinct on the two sides of the fence as are the associations of plants. What is more, they find that very rarely indeed do the insects characteristic of the drier short-grass group of plants stray over into the more luscious, if unfamiliar, vegetation of the normal prairie.

EARLY SWEDISH SURGERY

TREPANATION of skulls and other major operations were performed in Sweden 5,000 years ago, it has been brought out by excavations made on the Swedish island of Gothland in the Baltic Sea, by Dr. Gustaf Nihlen, archeologist of Stockholm. On the site of the present city of Visby, called "the city of ruins and roses," he found remains of an ancient fishing village dating from the Stone Age.

Examining a number of human skeletons, Dr. Nihlen discovered that experienced surgeons must have existed at

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Précis d'histologie physiologique. Second edition. O. POLICARD. 924 pp. $3.50.

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Causalität und Vitalismus vom Standpunkt der Denkökonomie. HANS WINTERSTEIN. Second edition (Abhandlungen H. 4.) Paper bound. About $1.

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GRAND CENTRAL TERMINAL, NEW YORK, N. Y.

that period. Neat, round holes were discovered in several skulls, showing that the art of trepanning as a cure against various kinds of ills was known. In performing these delicate incisions, the surgeons used an ordinary stone auger or drill, and it appears that in most cases the patient survived the operation.

Dr. Nihlen's examinations also disclosed numerous abnormal conditions, excrescences and deformities, showing that this prehistoric race must have been afflicted with rheumatism of the joints and similar diseases. These were probably brought on to a great extent by the hard climate and partly perhaps due to the exclusive meat diet, which also has been found to cause deformations of the jaws. It appears, too, that the Swedes in those days must have suffered very much from decayed teeth and toothaches. Another disease which evidently haunted ancient Visby and its inhabitants was rickets, and frequent epidemics seem to have ravaged the population. The death rate among children must have been very great.

PREHISTORIC RUINS IN COLORADO

A TRAGIC fire which laid waste a western Indian village more than 2,000 years ago is now proving an aid to modern science. The flames left the charred ruins in a state particularly favorable to preservation through the centuries. A Smithsonian scientist who excavated the abandoned village this summer has found there important evidence of a missing link in America's prehistory.

The village is in a remote district of southwest Colorado on the Piedro River. Dr. Frank H. H. Roberts, Jr., Smithsonian archeologist, has found there in the ruins a variety of skulls, many bone and stone implements and 250 pieces of pottery. These finds are now being studied by scientists at the Smithsonian Institution, and Dr. Roberts believes that they may be pronounced acceptable evidence of the hitherto missing link in the development of the prehistoric Pueblo people.

The oldest known inhabitants of the Southwest were the Basket-Maker Indians, who did not learn to make pottery until the closing days of their era. These were followed by the cliff-dwelling Pueblos, whose unique domestic habits and signs of high intelligence have made them a subject of intensive scientific research.

"One of the major questions confronting the archeologist and anthropologist in America to-day," said Dr. Roberts, "concerns what happened to these Basket-Maker Indians who immediately preceded the Pueblos. Did the Basket-Makers mix peacefully with the Pueblo tribes and lose their identity in the course of generations? Or were they wiped out by warfare?

"While I can not answer the question definitely now, my finds of this summer seem to throw important light on it, indicating that the first alternative is correct, and that the Basket-Makers did not perish suddenly as a race."

The architecture of the newly excavated village is of a transition type, between the old style Basket-Maker houses, and the later Pueblo ideas. All but three of the skulls are Pueblo in type, round-headed, with artificial flattening of the head caused by binding the babies' skulls to the cradles. The other three are long-headed and not flattened, representing the older race and the older idea of baby handling. The bone needles and tools were comparatively primitive, representing the older culture, but the pottery showed progress into the art ideals of the Pueblos.

The fire trapped some of the inhabitants of the village, and their charred skeletons were found still lying in the ruins of their homes. Jars filled with corn, beans and dried fruit, lying about the homes, indicated that the harvest had just been gathered when the catastrophe occurred.

ITEMS

MORE than 1,000 square miles of Alaskan wilderness, never before mapped and barely penetrated before by the white men, were surveyed by the U. S. Geological Survey during the past summer by means of the hitherto untried airplane-packhorse method, it is announced by S. R. Capps, geologist in charge of the expedition. Four trips were made by plane, Mr. Capps said, over the treacherous region of the Alaska Range in the south central part of the territory. Starting from Anchorage, the planes flew to the head of Lake Chakachamna, a body of water unknown to science until last year. "It took just about half as many hours to make the 150-mile trip," Mr. Capps pointed out, "as it does weeks to force a pack train through the roadless wilderness covered with glaciers, winding streams and deep-set gullies. Under the most unfavorable conditions, the planes made the journey in an hour and a half at most, whereas it took other members of our party close to three weeks to penetrate the same territory by pack-train."

TREES native to the temperate zone have made remarkable growth on the mountainsides of Hawaii, the U. S. Forest Service states. Coulter pines set out some 17 years ago at an elevation of 6,750 feet, east of Puu Nianiau on the private land of Kalialinui, have attained a height of 25 feet and a diameter of 12 inches. The pines have spread out enormously, much more so than in the United States, and have deposited a mat of needles six inches in depth, affording excellent watershed protection. In the same plantation western red cedars of the same age are now 21 feet high and eight inches in diameter, and white pines are 17 feet high and six inches in diameter.

EXPERIMENTS made at Giant Forest, Sequoia National Park, have shown that the California Big Tree, or *Sequoia gigantea*, sometimes retains its cones for sixteen years before they drop and discharge their seed contents. The seeds are preserved from weather and fungi by a powdery pigment which gives them a water-proof and germ-proof gloss. This pigment, when dissolved in water, makes a good writing fluid or furniture stain of a rich maroon color.

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SCIENCE NEWS

Science Service, Washington, D. C.

ICE FORMATION IN ALASKA

A STRANGE "near-glacier" of mammoth proportions was discovered in Alaska this summer during the expedition of the National Geographic Society to study volcanoes along the Alaska peninsula, according to C. P. McKinley, of the U. S. Geological Survey, who has returned to Washington after acting as topographic engineer on the trip. The expedition was led by Dr. Thomas A. Jaggar, director of the Hawaiian Volcanic Laboratory.

For lack of a better name, Dr. Jaggar termed the near-glacier an "ice-jumble," since he never before had seen anything like the peculiar geological formation. He expressed the belief that it is the result of the continuous dumping of volcanic ash into the area for hundreds of years. The materials consist, Mr. McKinley explains, of ice, gravel boulders, pumice, ash and sand in a vast hummocky sea. Four streams flow from the front of this near-glacier in virtually the same fashion as from an actual glacier. Near-by and above, the mighty Pavlof volcano fumes constantly from its symmetrical cone, a veritable American Fujiyama.

Another natural phenomenon witnessed by the explorers at close range for probably the first time in history was the great group of pinnacle-formed peaks on the peninsula known as the Aquileen Pinnacles. Averaging 4,800 feet above sea-level, they resemble a vast number of symmetrically formed church spires.

The expedition's route lay from Squaw Harbor on Unga Island, in the Shumagin group, to Canoe Bay, head of Pavlof Bay on the Pacific side of the Alaska peninsula, then along the shore of the Pacific westward to King Cove. Besides Dr. Jaggar and Mr. McKinley, the personnel consisted of R. H. Stewart, photographer; John Gardner and Peter Yatchmeneff, field men and a cook.

From a scientific standpoint, Mr. McKinley says, the expedition was a signal success. This was the second summer of the society's four- to five-year survey, under Dr. Jaggar, of the greatest chain of volcanoes in the North American continent. The party scaled a newly found volcano peak in the northern part of the Alaska peninsula; collected data for a topographic map of 1,500 square miles of hitherto unknown territory, and assembled a wide variety of geological, botanical and biological specimens.

Being marooned on an island without food for four days; hiking across miles of rough country filled with volcano ash that was knee-deep at times, and pulling horses out of almost impenetrable marshes, were a few of the unusual experiences that removed the daily routine from monotony.

GAS FUEL FOR THE COUNT ZEPPELIN

THREE thousand cylinders of special gas fuel for the German dirigible, *Count Zeppelin*, are lying at Lakehurst, N. J., ready to fuel the ship for its return voyage across the Atlantic.

Unlike the Blau gas fuel that the airship used on its voyage to America, the million cubic feet of American product is made from fractionated natural gas and is a synthetic mixture of ethane, about the density of air, methane, lighter than air, propane and butane, both heavier than air. These gases are carefully proportioned until the resulting mixture has a density of 1.05, only slightly heavier than air. Arrangements for the supply of this gas by a Louisville, Ky., concern were made by the U. S. Navy as an act of courtesy to the German ship, which is the guest of its sister, the dirigible *Los Angeles*, in its large two-berth hangar at Lakehurst.

Both the German Blau gas, so-called because it was first made by a German by that name, and the American substitute allow the dirigible to carry fuel which adds practically no load and does not make the ship lighter when it is burned, since it is nearly the weight of air. The fuel gas is carried in extra balloonets at the bottom of the giant envelope.

Blau gas is made by the distillation or cracking of gas oil, one of the heavier constituents of the refining of petroleum. In Germany it is obtainable commercially for heating and illuminating purposes, and a plant is located at Friedrichshafen, the home port and place of manufacture of the *Count Zeppelin*.

The use of air-weight gas fuel eliminates the necessity of a water-recovery apparatus such as devised by American government engineers for the conservation of weight on the dirigible *Los Angeles*. Any fuel when burned produces water by the union of the hydrogen of the fuel and the oxygen of the air and as this water is about equal in weight to the fuel consumed, it will maintain equilibrium of the ship if it is condensed from the exhaust gases and conserved. Such water recovery has worked successfully on the dirigible *Los Angeles* and it will be a question for future experience to determine which system will be used on the dirigibles of the future. Not all the fuel of a trip can be carried in the form of fuel gas, however, and *Count Zeppelin* relies largely on gasoline as the hundred or so Zeppelins did before her.

CARBON MONOXIDE POISONING

CARBON monoxide victims in closed garages and suicides by gas will in future become less numerous if the resuscitation method now being tried out by Dr. Ludwig Schmidt-Kehl, of the University of Würtzburg, works as well on human beings as it has on cats in the laboratory. Cats so far gone with carbon monoxide asphyxiation that they would surely have died have been "brought to" by placing them in a closed chamber of pure oxygen under pressure which is alternately decreased and increased in time with their own natural breathing rate.

Carbon monoxide poisoning, Dr. Schmidt-Kehl explains, is due to the abnormal appetite of the red blood corpuscles for the unwholesome gas. They take it up 250 times as readily as they do oxygen, which is the burden

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The Macmillan Company, New York

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In the class of elementary botany at the University of Wisconsin, this text has been used for several years. All parts of the book have been revised for the present edition.

THE QUANTUM AND ITS INTERPRETATION. H. Stanley Allen. pp. xiii + 274. 30 diagrams. $4.00.

Emphasis is placed on the magnetic aspect of the interpretation of the quantum, and a middle course is steered between a mathematical and a purely descriptive treatment. The plan of organization, the detailed description of fundamental principles, the bibliography and other paraphernalia make this work suitable for advanced text or reference use.

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The Committee on Drug Addictions, New York

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With the red corpuscles out of commission, the situation might seem to be hopeless. But it is pointed out that the blood fluid itself, which ordinarily carries so little oxygen that it cuts no practical figure at all in respiration, may be induced to load up with an emergency ration by placing the asphyxiated animal or person in a closed chamber of oxygen under pressure.

If the pressure is kept at a uniform level it must be relatively high; but Dr. Schmidt-Kehl has found that much lower pressures can be used if these are alternately increased and lowered, in time with the breathing rate of the victim. This simulated breathing in a closed chamber he has found is much more likely to revive semi-asphyxiated animals than a uniform high pressure.

Thus far the work has been done only with a small experimental apparatus, with a chamber only large enough to contain a cat. Considerable difficulties have still to be overcome before the method can be adapted to clinical use for saving asphyxiated human beings.

A PACIFIC EARTHQUAKE

THE Mexican Province of Oaxaca, on the Isthmus of Tehuantepec, was again shaken by an earthquake centered out in the Pacific Ocean, on the evening of October 8. The U. S. Coast and Geodetic Survey, after studying data gathered by Science Service, stated that the center of the shock was at 15 degrees north latitude and 97 degrees west longitude. This is about 200 miles due south of the city of Oaxaca and about 75 miles off the coast. The quake occurred at 10:01 P. M., Eastern Standard Time.

As previous quakes in the same place during the last year or so have resulted in considerable damage on land, it is probable that a large amount of destruction was done by this one, though damage to communication lines may delay the news from the damaged area. A quake earlier in the year which shook Oaxaca opened up an ancient tomb and revealed valuable relics to archeologists.

Seismograph observatories throughout the world recorded the quake. Those reporting to Science Service were located at Georgetown University and the Bureau of Standards, Washington; Loyola University, New Orleans; St. Xavier College, Cincinnati; St. Louis University, St. Louis; stations of the U. S. Coast and Geodetic Survey at Chicago and Tucson, Arizona; the Dominion Observatory, Ottawa, Canada, and the Weather Bureau, Manila, P. I.

THE VALUE OF ULTRA-VIOLET GLASS

SCHOOLROOMS and offices should spend their money on outdoor sun-parlors rather than on the new windows that allow ultra-violet light to pass through, is the advice given by Dr. Walter H. Eddy, of Columbia University, at the meeting in Chicago of the American Public Health Association. In homes and apartments these windows would be a great mothers' helper, saving the mothers from some of the hours spent walking up and down with babies and sitting in the park watching small children while they get their daily dose of sunshine.

Dr. Eddy experimented with rats that were fed on a diet that would result in rickets, unless they got enough sunlight to counteract it. These rats were placed in cages in front of the new windows at various distances and angles and for the same length of time. Only those rats directly in the path of the sunlight failed to develop rickets. Those that were more than a few feet away or next to the window, but outside of the path of the sun's rays, developed the disease.

Apparently the windows do permit the ultra-violet rays to pass into the room, but they do not go far enough or in sufficient intensity to take the place of outdoor sunshine. For office workers and school children, a few minutes' walk at noon will be more beneficial than all day spent in a room with ultra-violet light-transmitting windows.

THE MATERNAL DEATH-RATE

REDUCTION in our present high maternal death-rate must be based on adequate obstetrical training in the medical schools, members of the American Public Health Association were told at the Chicago meeting, by Dr. Carl H. Davis, chairman of the section on obstetrics, gynecology and abdominal surgery of the American Medical Association.

In spite of the fact that we have relatively few midwives, our maternal mortality is rather high compared with that of other countries. Obstetrics is the specialty of the general practitioner, the nucleus around which he builds his practice. This subject should be given more attention in the medical school, Dr. Davis advised, in order to reduce this high death-rate.

At the same session Dr. Blanche M. Haines, of the U. S. Children's Bureau, announced that maternal mortality rates for the entire registration area have shown practically no change in the period from 1917 to 1926. In the cities, the rate increased by 3.9 for every 10,000 births during this period. In rural districts a slight decline occurred. The rate for the whole area in 1917 was 66.2 deaths in every 10,000 live births. In 1926 it was 65.6 per 10,000.

Factors credited with the decline in the maternal death-rate in rural districts are educational work, improvement in obstetrical training of physicians, instruction and supervision of midwives, assistance of lay organizations of women in the educational program and extension of improved highways.

Twelve states are now studying the subject with the assistance of the Children's Bureau. Results are not yet reported from all states and no conclusions can be drawn from the studies at this stage.

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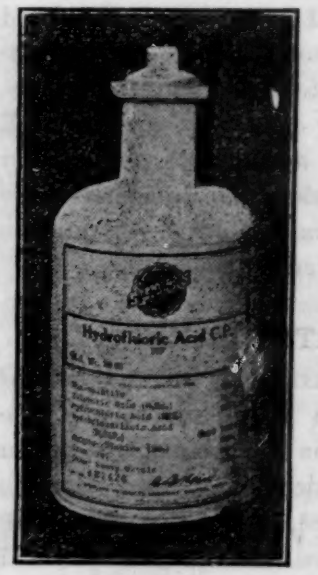

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The press prints "The Scientific Monthly," "Science," "School and Society," "The American Naturalist" and some twenty other scientific journals and publications. The typography and presswork of these journals will bear comparison with any weekly or monthly publication, although, for example, "Science" must be printed mostly in one day in an edition of over 13,000. The new edition of "The Biographical Directory of American Men of Science" is an example of the work of the press. It can to special advantage print scientific monographs and doctorate dissertations.

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The Science Press Printing Company
Lancaster, Pa.

tion of permanent deformity and paralysis, Dr. Wardner D. Ayer, of the Syracuse College of Medicine, stated at the assembly in Atlanta of the Interstate Post-Graduate Medical Association of North America. Dr. Ayer cited a series of 129 patients seen and treated by himself, of whom 96 made complete recoveries, 25 developed paralysis and eight died.

Of the eight who died, three received the serum too late and three did not receive enough, Dr. Ayer said, leaving only two cases as frank failures. Of the twenty-five that developed paralysis, ten were mild involvements that cleared entirely in six months and eleven were moderately severe with permanent weakness of one or more extremities. Of these twenty-five, only four were seen and treated within the first twenty-four hours of sickness.

The serum used in the treatment was mainly that taken from the blood of patients who had recovered from the disease. In a few cases non-immune horse serum was used. It is given by hypodermic injection into the spinal canal.

The extreme importance of the early use of the serum was particularly emphasized by Dr. Ayer, who pointed out that there is a three-day period of illness before paralysis, and that the disease can be definitely determined in that period. The best results are obtained when treatment is started during the first 24 hours of the illness. The serum is practically useless after the paralytic stage has begun.

SCIENTIFIC FOOD ADVERTISERS

If advertising would invoke the aid of science it must follow the rules that govern research in science, said Dr. E. V. McCollum, of the Johns Hopkins University, at the meeting in Chicago of the American Public Health Association. Particularly in food advertising, the public is being misled by a wrong use of science. Dr. McCollum presented a plan for an advisory board to consider food advertising.

The board would be composed of eminent scientific men and would only act to advise publishers on strictly scientific matters. This board would decide on questions of accuracy, authenticity, propriety and applicability of scientific statements in food advertisements.

Advertisers themselves are feeling the need of such a board, for the idea was first suggested by John Benson, president of the American Association of Advertising Agencies. Dr. McCollum believes that publishers are also feeling perplexed over the developments in advertising of food products, which have become so extravagant in their claims.

The reason for the fierce competition prompting this wave of so-called scientific advertisements of food is that we are at present eating all we possibly can without harm, says Dr. McCollum. Advertisers, in order to sell more of any kind of food, must take advantage of present scientific knowledge of our nutritional needs. However, too many of them are being led to give the public half-truths in place of scientific facts.

ITEMS

Trench warfare is recommended by the U. S. Department of Agriculture as an effective mode of combat against the fall army worm, now on the march northward from the Gulf States, toward the Mason-Dixon Line. Reports on the progress of this insect enemy, which causes enormous damage to cereal and forage crops, are arriving periodically at headquarters, and indications are that it may not reach the northern objective this year. Southern farmers whose crops are endangered by the foe are advised to dig or plow a narrow ditch, with steeply sloping sides, directly across the path of the marching raiders. The worms, attempting to cross, fall into such a ditch where they can be massacred by crushing them with a log dragged back and forth through it. Post-holes dug at frequent intervals in the furrow serve also as traps. These, says the department, should be partially filled with water. A layer of coal oil, or petroleum, spread on the surface of the water kills the worms that fall in.

If success crowns an experiment now being made, fishermen will have an opportunity to catch California's golden trout in Glacier National Park, according to a statement recently made by M. J. Elrod, naturalist of Glacier Park. The golden trout are natives of California's High Sierra, and to the lakes tributary to Kern River. They are beautiful fish of a golden color, and are limited in their distribution. The eggs for Glacier Park are being reared in troughs in the hatchery, and the young fry will be liberated in some of the barren lakes of the park this fall. Other fish plants at Glacier Park this season include native and rainbow trout and grayling. Over a million eggs have been furnished by the United States fish hatchery at Bozeman, Montana, for this purpose, and possibly another million may be supplied before the season is over. The native trout fry, of which there is a great preponderance, will be planted principally in the waters west of the Continental Divide, where this species does particularly well.

Milk or milk products are probably the source of undulant fever, the new disease that is becoming more and more prevalent throughout the country. This statement was made at the meeting of the American Public Health Association by James G. McAlpine, of the Storrs Agricultural Experiment Station, and Friend Lee Mickle, of the Connecticut Department of Health. Cattle of all kinds may be infected with the germ of the disease. In countries around the Mediterranean the goats carry the germs, but in this country it has been traced to cows, where it appears as infectious abortion. When human beings drink milk from such infected cows, they may get the human form of the disease, undulant fever. However, cows are infected with two kinds of the *Bacterium abortus*, the germ causing the disease. Probably only one of these two is capable of producing the disease in human beings, which is the reason why not every person drinking infected cow's milk gets it.

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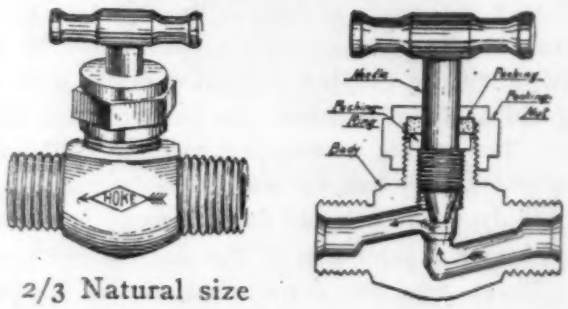

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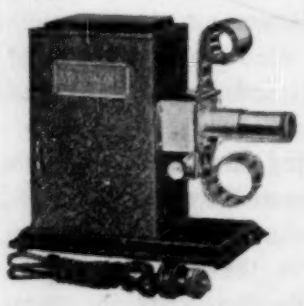

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SCIENCE NEWS

Science Service, Washington, D. C.

INVESTIGATIONS IN ALASKA

ALASKA, like Greece, had its golden age, when the people attained the high point of their culture and then dropped to a less admirable level. Evidence of this prehistoric golden age in the Arctic has been brought back to the Smithsonian Institution by Henry B. Collins, Jr., who conducted an expedition to St. Lawrence Island this summer for the Smithsonian and for the American Association for the Advancement of Science.

On the narrow strip of land called St. Lawrence Island, Mr. Collins found a remarkable mound about 20 feet high and large enough to be the site of a compact village. The mound was composed of trash, the refuse and sweepings from an entire village over a period of many centuries. Animal bones and broken tools, bits of ivory and whalebone, pieces of wood carved in fantastic design, all were mixed in with a binding of earth and permanently hard and frozen from the cold climate.

The most surprising moment in the digging came when the frozen bodies of some of the oldest inhabitants were discovered encased in ice. Six children had been buried there in the side of the mound, each one dressed carefully in his fur and feather garments. The place where they lay happened to become filled with water which froze, thus preserving the bodies through so many centuries. This is the only time that human bodies have been found in such condition, Mr. Collins states.

Ruins of houses made of driftwood and whalebone were in the top layer of the great mound, Mr. Collins said, in describing his excavation of the site. Digging to the bottom of the mound, he found the ruins of the homes of the oldest inhabitants. To reach the most deeply buried deposit, where the oldest layer of ruins lay, Mr. Collins had to dig six feet below the reach of the storm tides. In other words, he explains, the land has sunk since those houses were built on the beach, and this in itself indicates the passage of considerable time.

This oldest layer of houses dates back to pre-Russian days, the ethnologist declares. They are surely 300 years old, and more likely are nearer to being eight centuries old. The village is the most extensive Eskimo settlement ever excavated.

Many harpoons and other tools and weapons were brought back to the Smithsonian collection. Objects displaying the finest art in carving and design were taken from the lowest and oldest level of the mound. These were made in the days of the highest Eskimo culture. The precision of the lines and the fine designs used indicate that these inhabitants were far more clever with their hands and had a keener sense of beauty than any of their descendants in the Arctic. Whether they were some of the "first Americans," some pioneer Asiatics who brought knowledge and skill to the new world, can not yet be stated, Mr. Collins says. But it is certain that the Eskimos of historic times have lost a heritage of finer things, as the simpler carvings in the top layers of the mound show.

Present-day Eskimos, possibly direct descendants of the artists, came to the island and helped the scientist excavate. In some cases they were able to enlighten him as to the use of the peculiar articles discovered in the deserted village.

THE EUROPEAN BISON HERD IN THE CAUCASUS

THE wisent, Europe's representative of the bison family and close cousin to the American bison, appears to be certainly doomed to extinction. The herd of the Caucasus region, which numbered 1,000 head in 1911, has now totally vanished. So states Professor J. Pujanow, of Semferopol, who has just completed a survey of the status of this vanishing species.

In 1924 the Soviet government set aside an area of 1,100 square miles in the Caucasus as a permanent wisent reserve. At that time there were known to be 25 head of the animals still in existence in the region, and it was hoped that under protection they might stage a comeback like that of the American bison in the national parks of the United States and Canada. Parties of naturalists in the field in 1924 and 1925 failed to catch a glimpse of any of the animals, which remained hidden in the more remote fastnesses of the rugged terrain. Last year a larger group of zoologists who had had special experience with the wisent took the field and explored the region thoroughly, combing every valley.

They did not find a single living animal. They came upon plenty of bones, some of them bearing bullet marks, indicative of the inability of the inadequate government patrol to stop illegal shooting. The bones all seemed to be from animals not long dead—two or three years at most; so that it seems probable that the herd was there when the reserve was created for it, but has been wiped out since. There may still possibly be one or two wisent in remote haunts in the Caucasus, but they can no longer be counted on to help stay the march of the species toward extinction.

The wisent was formerly an important game animal in Europe, and until the seventeenth century was actively hunted. The advance of civilization in eastern Europe, however, drove it toward extinction as the advance of civilization later in western America threatened the New World bison. A large herd in the Baltic region was almost wiped out during the war; only five specimens now survive. There was also a wisent preserve in the Crimea before the war, but this was destroyed during the Russian revolution. There are still a few specimens scattered about in zoological parks in England and northern Continental Europe, and an association has been formed which is endeavoring to prolong the life of the species. But the news of the wiping out of the Caucasus herd comes as a heavy blow to the friends of the wisent.

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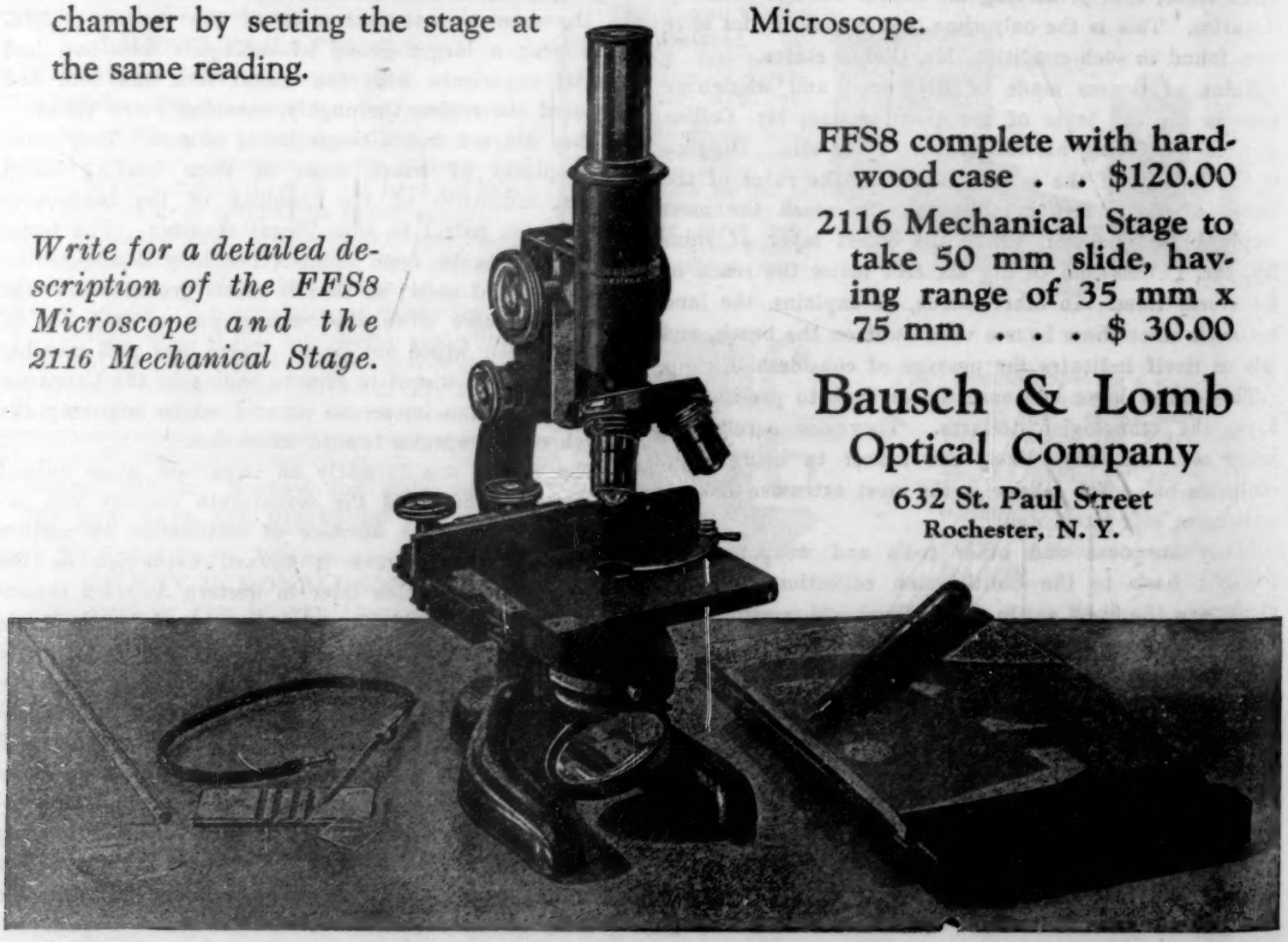

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THE MASSIVE JAWBONES OF SOUTH SEA ISLANDERS

MASSIVE jawbones, resembling in many details of structure the jaw of the ancient Heidelberg Man, have been found by Professor A. N. Burkitt, of Sydney University, in a collection of modern human remains from the South Sea island of New Caledonia. He reports his researches in the British scientific journal, *Nature*.

The discovery of the Australian anthropologist suggests the possibility of a revolutionary change in our assumptions concerning the kind of a person *Homo Heidelbergensis* was. It has always been taken for granted that he was a pronounced lowbrow. Though no skull of his race has been discovered, and a single jawbone is the only Heidelberg relic ever turned up, this jawbone is of such brutish proportions that the assumption has always been that the rest of his head must have been shaped to match it, and that in particular he had a low sloping forehead and a brain notably smaller than that of modern man.

The jawbones examined by Professor Burkitt are more advanced in structure than the Heidelberg jaw in some respects, notably in having more of a chin, but they are decidedly "Heidelbergian" in their general depth and massiveness and especially in the width and configuration of the ramus, or angle where the jaw fits into the cheek. But the natives of New Caledonia are not lowbrows; even though they are savages their skulls are "modern," and their brains are just about as large as those of contemporary Europeans.

This leaves us with the possibility, disquieting to current anthropological assumptions, that the massive-jawed Heidelberg man did not necessarily have a gorilline cranium. And nothing short of the discovery of a Heidelberg skull can really settle the matter.

THE SURVIVAL OF ARISTOCRATIC FAMILIES

ROYALTY and old families do not die out because of their age, neither do they become degenerate and sterile because of their wealth and power, according to Dr. F. A. Woods, of the National Research Council, in a report to the American Genetic Association. Facts taken from the history of the British peerage furnish proof of this, he says, in contradiction to popular notions about inherited wealth and position. Since families and family names continue only in the male line, many old families have become extinct only because all the children of one generation were girls. It is not fair to say that old families are dying out because certain names are no longer found in the peerage. On the other side of the picture, it was found that over half of the British peers of 1921 trace a continuously aristocratic descent in the direct male line to as early as the year 1450.

Every instinct and desire of powerful and wealthy families would tend biologically toward their growth in strength and numbers, Dr. Woods points out, mentioning the desire for children, particularly sons, and the selective mating of aristocratic families, a mating designed to strengthen the family.

While nine out of a certain ten old families may have died out, due to a preponderance of girl children, the remaining one will have branched out and ramified until fully ten important families of to-day can trace their descent from it in the male line. An example of this is the great number of aristocratic families, including 12 peers, descended from the old Stewart family of Scotland, the originator of the family line being the first Steward of the King of Scotland. Thus in actual numbers, a balance is kept, and aristocracy as a whole, as well as royalty, does not die out because of any degeneracy or weakness due to its rank or wealth.

Of the royal families of to-day, both reigning and non-reigning, nearly every one, through the male line, "shows a continuous position of nobility or royalty traceable as early as the eleventh century." Three or four thousand members of various royalties are living in Europe to-day, and they are all having large families.

THE GRAF ZEPPELIN

WHILE the *Graf Zeppelin*, world's largest airship, dwarfs her sister, the *U. S. S. Los Angeles*, American dirigible designers and enthusiasts are looking forward to 1931 when the all American *ZRS-4*, a dirigible nearly twice the capacity of the *Graf Zeppelin*, will take the air. A little less than a year later the *ZRS-5*, a sister ship from the same mold, will be produced here in America by the Goodyear Zeppelin Corporation as the result of a contract signed by the U. S. Navy just a few days before the *Graf Zeppelin* left Germany.

Even earlier, the *Graf Zeppelin's* world dirigible title will be challenged, for in England two dirigibles, both 5,000,000 cubic feet in capacity, are nearing completion. They are John Bull's bid for supremacy in the air lanes as well as on the sea's surface. America may expect visits from the *R100* and *R101* in the spring although they may be flight tested on the air routes to Egypt, India and Australia for which they were designed.

Not discounting the achievements of the *Graf Zeppelin's* flight, airship experts note that the new German airship is an enlarged edition of the *ZR-3*, now the *Los Angeles*, which four years ago made the same transatlantic crossing from Friedrichshafen to Lakehurst on its way to join the U. S. Navy. Twenty-eight balloonets instead of 24 make the *Graf Zeppelin* 771 feet long instead of 658 feet. The diameter of *Graf Zeppelin* is only ten feet greater than that of the *Los Angeles*. Both have five engines and their external appearances are similar. The principal difference in the interior is accommodation for the gas fuel balloonets at the bottom of the large envelope and an extra corridor or "cat walk" running the length of the ship.

The new Navy airships when completed will be only fourteen feet longer than the *Graf Zeppelin* but they will be 132.9 feet in diameter and hold 6,500,000 cubic feet compared with the *Graf Zeppelin's* 3,708,000 cubic feet. The American ships will incorporate some new design factors that promise to make them unique.

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G. P. Putnam's Sons, New York

FIELD BOOK OF NORTH AMERICAN MAMMALS. H. E. Anthony. pp. xxv + 625. 32 colored plates and 175 photographs and sketches. $3.50.

A detailed description of each large group of North American mammals with short synopses of the other related forms. The book treats of every species and subspecies of mammal, both land and marine, known north of the Rio Grande.

The Williams & Wilkins Company, Baltimore

LEAF-MINING INSECTS. James G. Needham, Stuart W. Frost and Beatrice H. Tothill. pp. viii + 351. Illustrated. $6.00.

A guide to the understanding of insect life for the general reader, an introduction to their natural history for the student of botany and entomology and a manual of technical information for the specialist.

The United States Government Printing Office, Washington, D. C.

FORTY-SECOND ANNUAL REPORT OF THE BUREAU OF AMERICAN ETHNOLOGY. J. W. Fewkes. pp. vii + 900.

A report for the year ending June, 1926, accompanied by several papers among which are: "A Study of the Social Organization and Social Usages of the Indians of the Creek Confederacy" and "Indian Trails of the Southeast."

D. Van Nostrand Company, New York

SOLUBILITIES OF INORGANIC AND ORGANIC COMPOUNDS. Atherton Seidell. Volume II. pp. vi + 1569. $8.00.

A compilation of quantitative solubility data from the periodical literature.

D. Appleton and Company, New York

THE STORY OF THE MOON. Garrett P. Serviss. pp. xii + 248. Illustrated. $3.00.

A description of the scenery of the lunar world as it would appear to a visitor spending a month on the moon. Illustrated with a complete series of photographs taken at the Yerkes Observatory.

Harcourt, Brace and Company, New York

HOW ANIMALS FIND THEIR WAY ABOUT. Etienne Rabaud. pp. ix + 142. 30 figures.

The greater part of this volume deals with investigations concerning invertebrates, more especially the insects. Among the subjects discussed are the hypothesis of a muscular memory and the role of smell.

Renouf Publishing Company, Montreal

ICE ENGINEERING. Howard T. Barnes. 364 pp.

This book treats of the physical constants of ice, rate of growth and melting of surface-formed ice, frazil ice, glaciers, icebergs, theories of the formation of anchor ice, ice remedial work and other aspects of the ice problem.

eight engines inside the hull. Engine specifications have not been announced but it is considered probable that gasoline will be abandoned for heavy oil fuel. The internal engines will allow the ship to slip through the air with less resistance and there will be less danger of the engines being torn off in a severe storm. A complete airplane hangar will be housed within the hull from which five airplanes can be launched from a trapeze, like performers at a circus.

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VEHICLE TUNNELS

How modern tunnels for vehicles under rivers, such as the Holland Tunnel under the Hudson, have been made possible by means of experiments on animals and experiments in which full-sized autos were driven through a small experimental tunnel, is revealed in a report to the Engineering Foundation at New York by A. C. Fieldner, chief engineer of the experiment station division of the U. S. Bureau of Mines.

When the Holland Tunnel was first proposed, says Mr. Fieldner, many engineers thought that it would be impossible to ventilate. The amount of poisonous carbon monoxide given off in the exhaust was thought to be so great that it could not be carried away.

Experiments made by Professor Yandell Henderson at Yale University showed that as much carbon monoxide in the air as 4 parts in 10,000 would not be harmful if the exposure did not exceed an hour. The first experiments were made on animals, then Prof. Henderson and his students tried it on themselves.

Then an experimental tunnel was built at the experimental mine of the Bureau of Mines near Pittsburgh. This was 9 feet wide, 8 feet high and 400 feet long. Above the ceiling was an air duct 3 feet high, and below the floor was one 2½ feet high. Either could be used for introducing fresh air or for exhausting contaminated air.

Small automobiles were driven back and forth through the tunnel at a speed of 10 miles an hour, and at 40-foot intervals. Tests were made with various methods of removing and admitting the air, and examinations of the drivers by blood tests were made before and after. It was found that the most efficient method of ventilating was to admit the fresh air at the bottom and to remove it at the top.

Another safety device developed by the Bureau of Mines in use in the Holland Tunnel is an automatic carbon monoxide recording machine, which rings a bell and flashes a danger light when the gas becomes more concentrated than 4 parts in 10,000. Then immediate steps can be taken to increase the circulation of air.

ITEMS

A NEW disease of the western yellow pine has been found in east central Colorado attacking young pines. About two thirds of all the trees in the region where the disease was discovered appear to be attacked, and about two per cent. of all the trees in the stand are killed by the disease each year. Apparently the virulence of the disease is influenced by the thriftiness of the saplings, for in those places where thinnings were made, removing the weaker trees, the death rate is greatly reduced. Then, too, even in dense stands not thinned, the diseased trees are always the slower growing ones. The new epidemic seems to weaken young trees, for diseased saplings break and bend more easily when weighted down with snow in winter than do healthy trees of the same size. The disease is being carefully studied by foresters and pathologists because the western yellow pine is one of America's most important forest trees, inhabiting about three fourths of the forest lands in the west.

SPORTSMEN should exercise care during the fall hunting season in handling the birds they bring down. Dr. R. G. Green and E. M. Wade, of the Minnesota State Board of Health, have succeeded in inoculating ruffed grouse with tularemia, the rabbit plague that has been transmitted to many hunters, market men and cooks who have handled the infected animals. The birds, the scientists report, succumbed to the disease in the laboratory as readily as guinea-pigs or rabbits, a condition that makes it seem extremely likely that they may be infected under natural conditions. The susceptibility of the grouse to tularemia was made the subject of experiment because it has been felt by scientists for some time that there might be a relationship between the disappearance of the grouse and the rabbit, both of which have been dying out in large numbers in states throughout the North during recent years.

MORE than 7,500 square miles of hitherto unexplored or little known Alaska territory, mainly in the southeastern regions, were mapped this past summer by geologists and engineers of the U. S. Geological Survey, according to Dr. Philip Smith, chief of the Alaska branch of the survey, who has now returned to Washington. Dr. Smith explained that while only about forty per cent. of the vast Alaskan territory is surveyed properly at the present time, there being several hundred thousand square miles yet to be mapped geologically and topographically in the north-central and southwestern regions, nevertheless the major districts with respect to mineral, fur and trade importance are now well known to science.

SOAP flakes and soap powders, being extremely explosive, take their place as the latest industrial hazard. Certain kinds of soap dusts when suspended in air are more violently explosible than most other industrial dusts, according to tests made at the Pittsburgh Experiment Station of the U. S. Bureau of Mines. These soap dusts are easily ignited and explode violently, accompanied by much flame and large quantities of heat. This is in spite of the fact that soap is a compound of semi-organic nature and that sodium compounds in general have a cooling effect on the flames of explosives.

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FOREIGN MEDICAL BOOKS RECENTLY PUBLISHED

Die Tumoren des Gehirns. Ihre Symptomatologie. Diagnostik u. operative Behandlg. auf Grund eigener Beobachtgn. L. PUUSEPP. 3 parts. Parts 1/2: 444 pp. Illustrated. Paper bound. $6.50.

Über das Problem der bösartigen Geschwülste. Eine experiment. u. theoret. Untersuchg. LOTHAR HEIDENHAIN. 153 pp. 141 illustrations. $7.68.

Mutationstheorie der Geschwulst-Entstehung. Übergang von Körperzellen in Geschwulstzellen durch Gen-Änderg. K. H. BAUER. 72 pp. 4 illustrations. Paper bound. $1.

Der Krebs des Menschen. Eine morphogenet. Untersuchg. EUGEN BOSTROEM. 176 pp. 17 illustrations. Paper bound. $2.88.

Die Blutgefässe der menschlichen Haut und ihr Verhalten gegen Reize. THOMAS LEWIS. Transl. by E. SCHILF. 297 pp. 76 illustrations. $5.76.

Klinik und Therapie der Blutkrankheiten. N. JAGIĆ and G. SPENGLER. 311 pp. 6 illustrations. 8 plates. $5.52.

Die Erkrankungen der Blutdrüsen. WILHELM FALTA. Second revised edition. 568 pp. 107 illustrations. $10.80.

Die Erkrankungen der Schilddrüse. BURGHARD BREITNER. 308 pp. 78 illustrations. $6.20.

Die Röntgen-Literatur. Edited by HERMANN GOCHT. Vol. VIII. 328 pp. $9.36.

Lehrbuch der Röntgenkunde. Edited by HERMANN RIEDER and JOSEF ROSENTHAL. Volume III. **Röntgentherapie.** Second edition. 865 pp. 161 illustrations. 9 plates. $15.60.

Kurzes Handbuch der gesamten Röntgen-Diagnostik und Therapie mit einem Anhang über die therapeutische Verwendung radioaktiver Substanzen. Edited by GERD KOHLMANN. 917 pp. 773 illustrations. 8 plates. $13.92.

Die klinische Röntgendiagnostik der inneren Erkrankungen. HERBERT ASSMANN. Fourth revised edition. About 1000 illustrations and 20 plates. Part one. 512 pp. Paper bound. $8.40.

Atlas typischer Röntgenbilder vom normalen Menschen ausgew. u. erkl. nach chirurgisch-prakt. Gesichtspunkten, mit Berücks. d. Varietäten u. Fehlerquellen, sowie d. Aufnahmetechnik. RUDOLF GRASHEY. Fifth edition. 236 pp. 373 illustrations. 234 plates. $6.24.

Grenzen des Normalen und Anfänge des Pathologischen im Röntgenbilde. Fifth enlarged edition. ALBAN KÖHLER. 582 pp. 324 illustrations. $9.12.

Dosierungstafeln für die Röntgentherapie. FRIEDRICH VOLTZ. Second edition. 145 pp. 21 illustrations. $1.50.

Die Röntgenstrahlen in der Embryologie und Geburtshilfe. W. DORLAND, A. NEWMAN, and M. J. HUBENY. Übers. u. hrsg. von. Wilhelm Lahm. Three volumes. 375 pp. Illustrated. $4.32.

Ergebnisse der medizinischen Strahlenforschung (Röntgendiagnostik, Röntgen-, Radium- und Lichttherapie.) Volume III. 791 pp. 613 illustrations. $18.10.

Atlas de radiographie osseuse. Part one. Squelette normal. G. HARET, A. DARIAUX and JEAN QUÉNU. 132 pages. 123 figures. $8.00.

Traité d'électrocardiographie clinique. PAUL VEIL and JUAN CODINA-ALTES. 450 pp. 197 illustrations. Paper bound. $5.70.

Électrothérapie. W. VIGNAL. 544 pp. 179 illustrations. 10 plates. $1.95.

Les Rayons ultraviolets et associés en thérapeutique. SAIDMAN. 840 pp. Paper bound. $4.00.

Jahresbericht uber die gesamte Tuberkuloseforschung und ihre Grenzgebiete. Zugleich bibliographisches Jahresregister des Zentralblattes für die gesamte Tuberkuloseforschung. Volume VI. Bericht über das Jahr 1926. 883 pp. Paper bound. $19.50.

Pathologische Anatomie der Tuberkulose. P. HUEBSCHMANN. 516 pp. 108 illustrations, many of these in colors. **(Die Tuberkulose u. ihre Grenzgebiete.** Volume V.) $21.36.

THE SCIENCE PRESS DISTRIBUTING COMPANY

GRAND CENTRAL TERMINAL, NEW YORK, N. Y.

SCIENCE NEWS

Science Service, Washington, D. C.

THE WORLD'S LARGEST TELESCOPE

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THE world's largest telescope, with a concave mirror two hundred inches in diameter, twice that of the greatest existing instrument, will be under construction within a few months at the California Institute of Technology. The funds will be provided by the International Education Board of New York, which administers some of the Rockefeller benefactions.

"The interest of the board is based chiefly upon the successful cooperation of the Mount Wilson Observatory and the California Institute, and their belief that the provision of additional means of furthering this joint work may lead to many new advances in astronomy, physics and chemistry. The full cooperation of the Carnegie Institution of Washington, of which the Mt. Wilson Observatory is a branch, has been assured by the unanimous action of President John C. Merriam and the executive committee of the institution, and by that of Director Walter S. Adams and other members of the Mt. Wilson staff. The research policy of the new Astrophysical Observatory of the California Institute, which will be designed to supplement and not duplicate the Mt. Wilson Observatory, will be determined by a joint committee representing the two institutions, aided by other leading investigators."

Dr. George Ellery Hale, honorary director of the Mt. Wilson Observatory, and chairman of the Observatory Council of the Institute, spoke of the plans in an exclusive interview to *Science Service*.

"In designing this instrument," he said, "we shall have the collaboration of leading physicists and engineers as well as of astronomers and instrument makers. When the telescope is completed it will be used to extend our present researches in various directions, as in spectrum photography of the stars, direct photography of very faint celestial objects, investigation of the nature of the spiral nebulae or 'island universes' beyond the Milky Way, and in radiometry, or the measurement of the heat from the stars. By making a special study of the various instruments and methods to be used in conjunction with the new telescope for these and other purposes, and by securing the cooperation of the ablest authorities, we expect greatly to increase the efficiency of the telescope.

"The equatorial mounting of the telescope will be designed by a group of experts, including Dr. J. A. Anderson, Dr. Francis G. Pease and other members of the staff of the Mt. Wilson Observatory, working in conjunction with several eminent engineers, opticians and physicists. It is the great mirror, nearly seventeen feet in diameter, double that of the largest that has yet been made, that will offer the most difficulty. We expect to make it out of fused quartz, and are much pleased by the cordial and generous offer of cooperation received from President Gerard Swope, of the General Electric Company, and Dr. Elihu Thomson, director of the Thomson Research Laboratory of this company at West Lynn, Mass. Dr. Thomson is deeply interested in the problem, and has already succeeded in making quartz discs of considerable size. His method is to cast a quartz disc full of fine bubbles and to fuse a layer of very pure quartz, free from bubbles, on the surface, in which to grind the proper dish-shaped figure. Such a mirror behaves as well as a perfectly solid one, and has the advantage of being lighter.

"The great advantage of quartz is that it changes its form so slightly with temperature. With the 100-inch telescope now at Mt. Wilson, we must always be careful to avoid exposing the glass mirror to the heat of the day, and some changes occur due to differences in temperature at night. With a quartz mirror the effect of temperature is too slight to give any trouble. We feel confident that, by the time we are ready for the mirror, Dr. Thomson will have succeeded in making a quartz disc of the requisite size. Pyrex glass, which is much better than ordinary glass, but not equal to quartz, might be used as a substitute if necessary."

Just how long it will be before the new telescope is in operation, it is at present impossible to tell, but it will doubtless be several years. The plans for this telescope have no connection with the project of Professor George W. Ritchey for a large telescope at the Grand Canyon, in Arizona. Professor Ritchey has been working in Paris for several years on a method of constructing large telescope mirrors in a cellular fashion, but it is not planned to employ his method in the 200-inch telescope.

The exact location of the new telescope also remains to be decided. Perhaps it will be placed on Mt. Wilson, 5,900 feet altitude, where there would be the advantage of proximity to the other observatory facilities. However, it is possible that the smoke, dust and glare of electric light from Los Angeles in the future, with the city's increased growth, may prove a disadvantage, especially because of the comparatively short focus of the instrument. Several other sites are therefore being tested in comparison with Mt. Wilson.

The trustees of the California Institute have placed the entire project in the hands of a committee of the executive council of the institute, consisting of Dr. Hale; Dr. Robert A. Millikan, director of the Norman Bridge Laboratory of Physics; Dr. Arthur A. Noyes, director of the Gates Laboratory of Chemistry, and Henry M. Robinson, well known for his work as a member of the Dawes Commission and in other international undertakings. Dr. John A. Anderson, physicist and astronomer of the Mt. Wilson Observatory, will serve as executive officer of the Observatory Council, in direct charge of design and construction. They will be assisted by an advisory committee including Dr. Walter S. Adams, director of the Mt. Wilson Observatory; Professor Fred-

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erick H. Seares, assistant director; Dr. A. A. Michelson, of the University of Chicago; Dr. Charles G. Abbot, secretary of the Smithsonian Institution; Professor Henry Norris Russell, of Princeton University, and Professors Richard C. Tolman, Paul S. Epstein and Ira S. Bowen, of the California Institute. George Eastman, and Dr. C. E. K. Mees, director of his research laboratory, have offered fullest cooperation in the study of special photographic problems. Ambrose Swasey, chairman of the Warner and Swasey Co.; Dr. Gano Dunn, president of the J. G. White Engineering Co., and recently chairman of the National Research Council; Dr. Frank E. Ross, of the Yerkes Observatory, and others equally well known, will aid in the work of design, and many other scientists especially qualified will contribute useful suggestions.

ATOMIC LAYERS

LAYERS of metallic rubidium, only one atom deep, so thin that several million would be required to equal the thickness of the paper this is printed on, have been measured at the Bell Telephone Laboratories. Thin films of rubidium, a metal similar to the sodium of common salt, are important because of their use in photoelectric cells.

As the magic lamp of modern physics, the photoelectric cell, transmuter of light variations into sound, is the very heart of the revolutions in industry that have been plotted in the physics laboratories. Talking motion pictures, radiovision, television, telephoned photographs would all be impossible without the photoelectric cell.

In the course of researches on how to make the photoelectric cell most efficient, A. L. Johnsrud measured the thin films. When the thin film of metal inside the glass cell was very thin it operated better than when thicker. Rubidium can be made into thin films more easily than its relative metals, because at rather low temperatures and without loss of time it can be made to evaporate and the vapor deposited, in a vacuum, to form such a film.

A large photoelectric cell was made and so arranged that rubidium could gradually be deposited on the glass, or else, after a thick deposit had been made, it could gradually be removed. While the film was thus getting thicker or thinner, the photoelectric response, the current given off when light fell on it, could be measured. Since the maximum response was obtained at the same point, whether the film was growing thicker or thinner, it was necessary exactly to record the film's depth.

Ordinary measuring methods proved inadequate and polarized light was used. When polarized light passes through any film, such as the one of rubidium, the direction in which it vibrates is twisted. The thicker the film, the more it is twisted. By means of another prism similar to that which polarizes the light the extent of the twisting, and also the thickness of the film, is measured. The most current was obtained when the film was but one atom thick.

INDIANA MOUND SURVEY

BURIAL and ceremonial mounds of earth and stone, which are the only monuments left by the prehistoric and early historic inhabitants of this continent, have been the objects of a survey conducted during the past summer by the Indiana Historical Society and Historical Bureau, under the direction of Dr. C. B. Coleman. Many of these artificial hillocks have been destroyed by cultivation, and it is desired to obtain a complete record of the rest before they meet a like fate.

The valley of the Whitewater River, near the Ohio border, was chosen as the best place to begin, in part because of the possibility of finding here culture remains related to those of the famous mounds of Ohio. Two counties in this valley have been surveyed, and several mounds explored. The archeological remains in them were not rich, but may be taken as good promise of valuable data to be expected when the explorations can be made more general.

One mound near Brookville was entered because it was being cut away by the river on one side and by the highway on the other. In the remaining portion a great mass of incised pottery fragments was unearthed, and evidences of fire were widespread. Two skulls and a number of other human bones were found, bearing some signs of having been deposited by cremation burial. With them were margrinda beads, slate ornaments, tools of bone and a single arrow-point, probably left as funeral gifts.

The survey will be continued this fall as long as weather permits, and will be taken up on a larger scale next spring.

EARTHQUAKE IN THE NICARAGUA AREA

THAT troubled Central American republic, Nicaragua, now being controlled by U. S. Marines, was shaken by the earthquake that was recorded on seismographs of this country Thursday morning, October 25.

The disturbance itself sent the news by its world-shaking waves to the earthquake observatories and their reports wired to *Science Service* and interpreted by the U. S. Coast and Geodetic Survey allowed the quake to be located at approximately 12 degrees north latitude and 86 degrees west longitude. The exact time of the shock was 7:32.8 A. M. eastern standard time.

It is considered possible that some damage was caused by the earth disturbance, although the U. S. Marine headquarters at Washington has not yet received any report.

Earthquakes in Nicaragua interest American authorities not alone because of the marine occupation but because the United States acquired by purchase twelve years ago the right to build in the country a ship canal between the Atlantic and Pacific. Earth disturbances would be likely to damage such a canal.

Seismograph observatories throughout the world recorded the quake. Those reporting to *Science Service* were located at Georgetown University, Washington; the Dominion Observatory, Ottawa, Canada; observatory at Harvard University, Cambridge, Mass.; station of the U. S. Coast and Geodetic Survey at Tucson, Ariz.; Fordham University, New York City; St. Louis University, St. Louis, and the Meteorological Observatory, at Victoria, B. C.

NEW SCIENTIFIC BOOKS

John Wiley & Sons, Incorporated, New York

AGRICULTURAL GEOLOGY. Frederick V. Emerson. Revised by John E. Smith. pp. xvi + 377. $3.25.

The subject-matter and mode of treatment are the outgrowth of some years of experience in teaching geology to agricultural students. It is also hoped that the book will be serviceable for reading and correspondence classes.

The Open Court Publishing Company, Chicago

A HISTORY OF MATHEMATICAL NOTATIONS. Florian Cajori. Volume I. pp. xvi + 451. 106 illustrations. $4.00.

This history of mathematical notations constitutes a mirror of past and present conditions in mathematics which bear on the notational problems now confronting mathematics.

The Macmillan Company, New York

ELEMENTARY LABORATORY EXPERIMENTS IN ORGANIC CHEMISTRY. Roger Adams and John R. Johnson. pp. xi + 304.

A flexible manual for half-year or year courses adaptable to the needs of chemical engineers, pre-medics and biochemists. A suitable companion volume to Conant's *Organic Chemistry.*

PRINCIPLES OF PLANT PHYSIOLOGY. Oran Raber. pp. xiii + 377. 29 figures.

Written particularly as a book for students and not for teachers, a text-book and not an exhaustive treatise.

WHEAT FLOUR AND DIET. C. O. Swanson. pp. xiii + 203. 18 illustrations.

Wheat flour constitutes one third of the total food of the American people. This book is a popular contribution to the current discussion of human nutrition, and describes the milling processes commonly used. It should be useful to students and teachers of home economics, diet and nutrition.

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A WEATHER STATION IN ALASKA

RADIO weather reports of observations taken by a young woman at the coldest and most inaccessible weather station in United States territory at Point Barrow, Alaska, will enable warnings of cold waves affecting the North Central states to be sent out this winter several days earlier than has previously been possible.

Mrs. Beverly A. Morgan, wife of the Army Signal Corps radio operator at the trading post, has recently been appointed observer at Point Barrow. She is one of the six white inhabitants of the town. Arrangements have been made for the first time to radio observations from this station twice daily to Weather Bureau headquarters in the United States.

The recent opening of daily communication with this station makes forecasting data on weather conditions on the Arctic Ocean available for the first time. Most of the cold waves and other atmospheric disturbances affecting the northwestern states originate in that region of the Arctic. Observations previously taken at this station were sent by mail to the United States, reaching the forecaster's office months after they were made. They were, of course, useless in making the weekly and daily weather forecasts and valuable only as a matter of record. The Point Barrow is over 450 miles north of the other weather outposts sending in wire or radio reports.

Charles L. Mitchell, chief forecaster of the Weather Bureau, places great stress on the value of these new data. He states that "this daily contact with the most northern settlement on United States territory will give us data which will enable us to trace the origin, force, extent, probable duration and intensity of each disturbance near the point of its origin, so that we will be able to predict its probable effect on crops, shipping and household arrangements many days before it will arrive."

It is thought that the observations from Point Barrow will have a vital effect on making the weekly weather forecast for the various sections of the United States more complete, and will allow the predictions of cold waves to be felt six or seven days after the report is issued. This is not always possible now.

Mrs. Morgan and her husband will live in the most primitive surroundings with only a few score people within hundreds of miles. Their only communication with the outside world, with the exception of their radio, will be a steamer once and sometimes twice a year. Sometimes even this powerful icebreaker is unable to penetrate to the post for months after her scheduled arrival. Shortage of food and other supplies has often caused serious hardship at the station, necessitating rationing of food. The temperature averages 19 degrees below zero during the coldest winter months and has been known to reach 55 degrees below zero.

Despite these hardships Mrs. Morgan has pledged herself to make the routine observations twice a day regardless of weather, storms, sickness or other conditions. Many of the instruments require considerable mechanical attention and Mrs. Morgan will perform these duties in addition to her work as observer.

The linking of the Point Barrow station into the twice daily observation scheme completes the chain of eleven Alaskan stations distributed at strategic points throughout the territory, each sending by radio or wire the required data.

Bureau officials are now considering some means of extending the observation system into Siberia and islands in the Arctic Ocean, so that reports will be available even closer to the origin of every disturbance which would affect the United States.

ITEMS

A NEW astronomical observatory, equipped with two large telescopes, as well as smaller instruments, will soon be under construction at Saltsjoebaden, just south of Stockholm, under the auspices of the Royal Academy of Sciences. The new observatory is made possible by the sale of the old observatory of the academy for one million crowns (about $270,000) and the donation of a like amount by the former secretary of state for foreign affairs, K. A. Wallenberg. A 36-inch reflecting telescope and a 20-inch refractor for photography will be the chief instruments. Professor Bertil Lindblad will be the director.

A NEW X-ray laboratory, for use in plant breeding experimentation, has been installed at the University of California, and will be available for cooperative researches by workers in other parts of the country. The plan is to have projected experiments submitted in outline to a special Committee on X-ray Experimentation at the university, and when this committee has given its approval, the pollen or other plant material to be X-rayed will be sent in to the laboratory, treated and returned to the experimenter, who will observe and report the results obtained. In this way it is hoped to develop new varieties of fruits, crop plants and ornamentals which might never have come into existence. At the same time, results of value from the purely scientific viewpoint are expected.

THE health-giving ultra-violet rays of sunlight, which everybody wants nowadays, pass through cotton, linen and rayon fabrics about equally well when these are of equal weight and closeness of weave. Fresh, white, natural silk is almost as transparent toward the rays as bleached cotton, while wool is only about half as transparent. These are some of the results obtained in a study of the transmission of ultra-violet radiation through various fabrics, conducted at the U. S. Bureau of Standards by Dr. W. W. Coblentz, Dr. R. Stair and Dr. C. W. Schoffstall, and reported in the bureau's new *Journal of Research*. "In all cases when the fabric is dyed, or slightly yellowed with age, the ultra-violet transmission through the thread is greatly decreased. Hence, as is to be expected in comparing various kinds of dyed fabrics, the one having the largest openings between the threads transmits the most ultra-violet."

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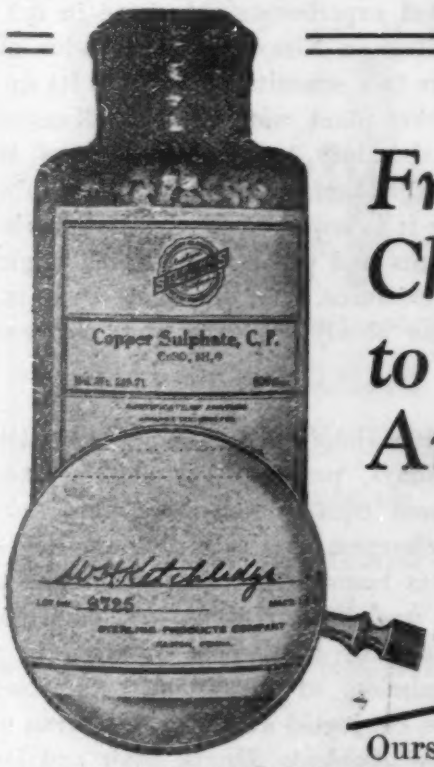

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SCIENCE NEWS

Science Service, Washington, D. C.

THE MICHELSON-MORLEY EXPERIMENT

EINSTEIN'S theory of relativity still stands. The Michelson-Morley experiment, which many years ago failed to show an expected motion of the earth through the ether of space, and led to the relativity theory as an explanation, still fails to show any such motion. At the meeting of the Optical Society of America in Washington on November 2, Professor A. A. Michelson, physicist and Nobel prize-winner of the University of Chicago, announced the final results of a repetition of his classic experiment.

Working at the Mt. Wilson Observatory in Pasadena with much improved apparatus, capable of detecting a motion as much as 2 per cent. of that expected, none was found. The very slight effect found was less than that to be expected by experimental error and not more than a tenth of what he found before.

Physicists regard this announcement as showing that Professor Dayton C. Miller, of the Case School of Applied Science in Cleveland, was mistaken in supposing a few years ago that he had found such an effect, though smaller than originally expected. So far, however, they are unable to explain the source of Professor Miller's error.

OUTDOOR TELEVISION

BIG television transmitters, or extremely sensitive photoelectric cells, contain the secret of successful outdoor television. This was the message brought to the Optical Society of America at its meeting at the Bureau of Standards by Dr. Frank Gray and Dr. Herbert Ives, who are chiefly responsible for the success of the Bell Telephone Laboratories' system of television.

When first publicly demonstrated the Bell method employed beam scanning. A narrow and intense pencil of light rapidly covers all parts of the subject and the light reflected is picked up by a battery of light-sensitive cells. This obviates the use of objectionably brilliant flood lighting of the subject. This method can not be used out of doors because of the interference of daylight, as well as its limited range. Ordinary daylight is not sufficient to operate the transmitter with ordinary equipment.

By using an extra large lens, with an extra large scanning disc, and extra large holes, several times as much light can be picked up and focused on the surface of the sensitive cell. But the picture also is larger, and so the relation of picture size to the size of the individual elements remains the same. The picture shows just as much detail as with the smaller apparatus. As photoelectric cells are becoming more sensitive, it is not necessary to make the scanning discs unreasonably large.

Dr. Gray stated that there was a curious optical illusion which helped them out in televising full length figures. "It has been held," he said, "that in order to produce satisfactory television images of full length figures or groups of figures it would be necessary to use a very much finer grained image than those that have been used thus far for the transmission of the human face.

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"The effect is very much as though the observer were looking through a window. If someone on the other side of the window holds his face up close enough to fill the whole opening we expect to see fine detail in the face. If, however, the person walks away from the window until we see him at full length, we no longer expect to distinguish fine details of the face."

THE PANORAMOGRAM

A NEW camera that makes photographs that appear solid to the eyes, and which shows different sides of the object depending on which way one looks at the picture, was shown at the meeting of the Optical Society of America.

Dr. Herbert E. Ives, under whose auspices television was developed by the Bell Telephone Laboratories, described the new camera, which he designed. The pictures made with it are called "parallax panoramograms." They differ from the double stereoscopic pictures, used in the old-fashioned twin lens hand stereoscope, because no optical aid is required between the eye and the picture. Also, the old style stereograms only show the subject as it would appear to a pair of eyes in one position. With a panoramogram of a person's head, for instance, if one looks at it from directly in front, he sees a full view of the face. If the picture is looked at from the side, one side of the face is seen. It is in full stereoscopic relief all the time.

The pictures are a modification of an invention of Dr. Ives's father, Frederic E. Ives, pioneer in the invention of the half-tone process of reproducing photographs. With this parallax stereogram, as it was called, two pictures were taken with two cameras separated by the distance separating the average pair of eyes. These were then combined on a glass transparency, so that the picture consists of fine vertical strips, about 200 to the inch. One strip shows part of the picture seen by the left eye, the one next to it that of the right eye, then the left eye picture again, and so on.

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Another glass is firmly mounted a short distance in front of the picture and on it are alternate clear and opaque vertical strips the same width as those of the picture. When the stereogram is held at arm's length and viewed against a light, the right eye sees only the strips of the picture made with the right hand camera. Those of the left hand picture are covered by the dark strips. But for the left eye the case is reversed. It sees only the left hand picture, and the right hand one is covered. Thus the two views are combined, and the picture is seen in stereoscopic relief.

In the new method, which is the invention of Dr. C. W. Kanolt, formerly of the U. S. Bureau of Standards, although Dr. Ives designed the camera that makes them, the picture is made from different angles. The Ives camera moves along a track in front of the subject during the exposure, so that the center of the subject is always on line with the center of the plate and the center of the lens. Just in front of the plate is a glass grating of alternate vertical light and dark strips, but the clear spaces are only one tenth the width of the dark ones. The finished picture consists of strips, but one part of each strip shows the picture from one angle, while another part shows it from another angle. A similar grating is placed over the finished transparency, and so no matter what angle the picture is viewed from the proper picture appears. Unfortunately, so far as can be foreseen, there is no practicable way of applying the method to the movies.

MOTION PICTURES OF THE PLANET JUPITER

SCIENTISTS attending the meeting of the American Optical Society at the Bureau of Standards paused from listening to papers on research to see a movie. They applauded it with as much vigor as any screen star ever received in a theater. The star of this movie was a heavenly "star"—the planet Jupiter, appearing on the screen for the first time in America.

Jupiter came into view, slowly and steadily turning as if driven by an electric motor. The great red spot and other details of its surface familiar to astronomers passed across its face. One of the moons of Jupiter came on to the screen from the side, rapidly approached the planet, then its shadow appeared on the planet's surface. Finally the grayish disc of the moon itself was seen silhouetted against the bright planetary background, though not as dark as the shadow.

These motion pictures, the first of their kind ever made, are the work of Professor W. H. Wright, of the Lick Observatory, in California, and Dr. C. E. K. Mees, director of the research laboratory of the Eastman Kodak Company. Every minute or so during the whole of one night, Dr. Wright made photograph after photograph of Jupiter with the observatory's great 36-inch telescope. Jupiter turns completely in 10 hours, but as the best results could only be obtained when the planet was fairly high in the sky, it was necessary to repeat this on several other nights. Thus every aspect of Jupiter left its record on the sensitive plates.

Dr. Wright then turned the negatives over to Dr. Mees, and he combined them on a motion picture film. This was particularly clever work, for each successive image must be in exactly the same place, or else the planet will seem to wabble when shown on the screen.

At a meeting of the Royal Astronomical Society in London last summer Dr. Wright showed these for the first time. There they proved a genuine sensation to the astronomers.

LIGHT REQUIREMENTS OF PLANTS

IT might seem to the layman as if a growing plant out in the open undergoes such extremes of light and darkness that it would thrive under almost any conditions of quality or intensity of radiation. But this is not the case, and plants are easily affected by changes in color or duration of light, members of the Optical Society of America were told by Dr. John M. Arthur, of the Boyce Thompson Institute.

Though plants can be grown under electric light, some do not thrive if the light is kept on all the time. The tomato, he said, is killed by continuous illumination. After about five days a leaf injury appears and this increases until most of the leaves have withered and dropped off. In general, 18 or 19 hours a day of light gives as rapid growth as when the light is continuous. Buckwheat takes almost anything that is offered, for it flowers with anywhere from five to twenty-four hours of light a day.

Just as the short rays of light, known as the ultra-violet, cause sunburn and damage to the human tissues, so do they affect plants. Dr. Arthur also told of recent experiments which show that the very short waves will soon kill plants. Ultra-violet rays were produced with a quartz tube mercury vapor arc lamp. Filters were placed over the lamp to cut out some of the shorter rays.

In this way it was found that when rays as short as 237 millionths of a millimeter, about one hundred thousandth of an inch, were used, a large part of the leaf area of a tomato plant was killed in 30 seconds. But when the shortest rays were 286 millionths of a millimeter, there was no injury at all. In sunlight at sea-level, the shortest ultra-violet rays are about 300 millionths of a millimeter in length. The shortest visible violet rays are about 400 millionths, and the longest red rays that we can see about 700 millionths. All of the visible colors come between these limits.

CATHODE RAYS AS A LABORATORY TOOL

THE wonder-working cathode rays, first obtained in large quantities in the open air two years ago by Dr. W. D. Coolidge, of the General Electric Company's research laboratory, are now at the disposal of any well-equipped research institution. The effects of the rays on all sorts of living and mineral matter can now be studied.

This is possible with a new form of the tube, simpler than an X-ray tube, and hardly more complicated than an electric light bulb, which has been perfected by Dr. C. M. Slack, of the Research Department of the Westinghouse Lamp Company, at Bloomfield, N. J.

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Cathode rays were first studied as they were produced inside glass tubes made by the English scientist, Sir William Crookes. Then, in 1894, a German, Professor P. Lenard, first succeeded in getting them in feeble quantities in the air. Dr. Coolidge, in 1926, invented a tube in which they were obtained in large quantities in the open air.

The rays consist of speeding electrons, the "atoms" of an electric current, and of which the atoms of matter are supposed to be built. In the Coolidge cathode ray tube they are produced by a glowing electric light filament, and given their great velocity by the application of an electric potential of several hundred thousand volts. This is sufficient to drive them through a thin nickel window at the end of the tube, where they cause the air to glow, as well as other curious effects.

Dr. Slack's improved tube dispenses with the nickel window and uses a bubble of glass, but so strong is it that the pressure of the air on the outside is not sufficient to break it, and destroy the essential vacuum within. Some of these windows are only one five thousandth of an inch thick and an inch in diameter.

They are made by drawing in a bubble of molten glass on the end of the glass tube, and then allowing it to freeze. Thus it automatically assumes the shape so that the air pressure afterwards is the same as that during its formation, and it will stand surprisingly high pressures. The glass is so thin that the electrons, or cathode rays, can sneak through the spaces between the glass atoms, even though these spaces are not large enough for the air atoms to squeeze through in the other direction.

SOUTH SEA FIELDS OF PUMICE

VAST fields of pumice and volcanic ash, floating on the surface of the south Pacific Ocean between the Fiji and Tonga groups of islands, are the first indication of a new submarine volcano. Perhaps it may finally lead to the formation of a new island, for Falcon Island, 120 miles to the southeast, appeared about a year ago, formed from similar volcanic material.

The announcement of the floating pumice was made to *Science Service* by Dr. Andrew Thomson, director of the Apia Observatory. A British ship, *H. M. S. Carisso,* was the first to report it. It was first observed on the evening of October 3, about 240 miles east of Suva, Fiji. During that night patches each several miles in extent were passed, the last one sighted about 70 miles southwest of the first. On October 7 another ship, *H. M. S. Veronica,* sighted some more floating pumice about 30 miles west of this, about a mile in diameter. A sounding was made, but with the line let out for 1,200 feet no bottom was found. The next day, farther east, they encountered the largest field of all, about a half mile broad, and extending for many miles in a north and south direction.

"The position of the submarine volcano which has thrown out the immense quantity of material reported can not be located with the information now available. The surface drift of the ocean in this area is from the northeast and east so that the probability is that the volcano is eastward but not far from where the pumice was first seen at 17 degrees 25 minutes South Latitude, 176 degrees 09 minutes West Longitude.

"The ocean floor between the Tongan and Fiji islands is fairly level to the west of longitude 173 with an average depth of 1,500 to 2,000 fathoms. It is an area of great seismic activity for no less than ten violent earthquakes have occurred in 7½ years (1913–1920) at two principal centers.

"The pumice fields lie about 75 miles south of one of these epicenters.

"A large earthquake took place on September 6, at 8:50 A. M. Greenwich time and the locality, about 100 miles southwest of Samoa, is known to have yielded pumice on at least one previous occasion within the records of this observatory. It seems probable that if the present field had come from this epicenter at the beginning of September, it would have been observed before now."

ITEMS

THE bark of a California Big Tree is, on large specimens, as much as three feet thick and is almost as resistant to fire as asbestos. A sample of the bark twelve inches square was placed in a lumber mill furnace, surrounded with dry pine and fir wood and burned for eight hours. When taken from the furnace the Big Tree bark was merely charred on the outside. This resistance to fire is one reason for the longevity of the California Big Tree, which is known to attain an age of four thousand years and may reach six thousand or more. A mature specimen, twenty feet or more in diameter, sustained scores of forest fires in the days before the national parks and forests were protected. Other conifers of the western mountains, notably the sugar pine, yellow pine, red and white fir, also possess thick fire-resisting bark, but the *Sequoia gigantea* is the Shadrach, Meshach and Abednego of the forest world.

ULTRA-VIOLET light is now proving a boon to the stock-farmer. Besides maintaining cows, race-horses, etc., in good health during the sunless months of winter, it is improving their condition so that they bring a higher price in the market, according to the results reported by V. M. Weall, of Surrey, England, who experimented with pigs. Twelve pigs were given treatment with ultra-violet light for three minutes daily when they were 10 to 12 weeks old, the time of treatment being gradually increased to 20 minutes. This was maintained until the animals were sold at the age of 20 weeks. Twelve similar pigs were kept as controls without light treatment. All 24 were sold on the same day and in every case the irradiated pigs sold for a far higher price than the untreated animals. Economically the experiment was highly successful because the extra money obtained for each pig was 14 times the cost of the operation of the quartz lamps which were used for the irradiation.

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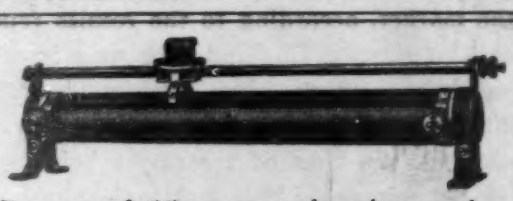

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SUGAR FROM WOOD WASTE

CARBOHYDRATES, taken directly or indirectly, whether by human beings or animals, are essential for nutrition. They represent a concentrated product of the energy of the sun. After undergoing certain changes they serve as fuel to produce the various kinds of energy which sustain life. In plant-life nature produces carbohydrates in different forms, some of them being directly serviceable for digestion on the part of most animals, others fit for use only by innumerable sorts of so-called lower organisms, especially by microbes.

The various carbohydrates differ only very little among themselves as regards their elementary composition, but these small differences divide them into two classes by reason of their vastly different mercantile value.

Agriculture, by gradual development in the course of thousands of years, has produced in very large quantities a rather small number of species containing carbohydrates in such form as makes them available for use as food for human beings or for cattle. Nature produces still larger quantities of carbohydrates which are digestible as such only in small part in the stomachs of men and beasts. Their main representative is the wood-pulp which is contained to a very large percentage in the waste products of agriculture, especially in wood. Immense quantities of such waste products are at disposal, in this country especially in form of corn-stalks. A considerable part of such waste wood, as we know, is not used in an economical way. In producing lumber, at least 40 per cent. of the wood falls off as waste, being used either not at all or at best as fuel. Burning up wood means destruction of cellulose, that inner chemical substance of wood, so valuable commercially.

The present enormous request for print paper steadily diminishes our stock of wood in the present, while seriously endangering our future supply. A possibility of turning the forest waste into human nutriment or fodder for cattle might considerably influence agricultural and forest policies in vast territories of the world.

In the course of such reflections the question arises whether it might not be possible for chemistry slightly to alter the cellulose molecule so as to bring it into such form that it may act in the stomach just like digestible carbohydrates of starch or of sugar. This can indeed be accomplished by merely adding one molecule of water to one molecule of cellulose—a simple chemical reaction which has been known for more than a century. Nevertheless, well-known insignificant chemical reactions, easily produced in the laboratory, sometimes involve enormous difficulties when it comes to putting them to test on a technical scale and at the same time on an economic basis.

A number of processes to realize chemically the reactions of hydrolyzing wood-pulp have been developed in the course of time, the first practical application having been carried through many years ago, in this country, near Chicago. The aim of all these processes has been to transform wood-pulp into a fermentable product, to be used in the manufacture of alcohol. All these methods have failed economically until now, because they have not yielded enough fermentable stuff.

While the production of alcohol has been the ultimate goal of processes of hydrolyzing wood-pulp at high temperature, the transformation of wood-pulp into foodstuffs has become the aim of a new technical method developed during the last twelve years under my supervision.

In Germany, some fifteen years ago, Willstaetter found by the action of highly concentrated hydrochloric acid that wood-pulp could be almost quantitatively transformed into soluble carbohydrates and finally into glucose. On the basis of these laboratory results, we worked out my process allowing a yield from every hundred parts of any dry wood about 75 parts of crude foodstuffs, containing 80 per cent. of pure carbohydrates. That means 60 per cent. of pure carbohydrates is obtained from the dry wood. This product proved to be of high nutritive value and equal to any other foodstuff of like starch concentration and particularly adaptable to the raising of pigs. Successful experiments have been made to transform the primary product, glucose, for nourishing human beings. We have succeeded in evolving a simple cleansing process for this purpose and have produced pure glucose.

Considerable difficulties had to be overcome during the twelve years of development of the technical methods and apparatus. The most difficult problem has been the separation and recovery of the highly concentrated hydrochloric acid, while no less serious and hard work on the part of a rather large staff of chemists, engineers and workmen had to be done to find the most practicable way of handling the wood, preventing leakages of hydrochloric acid vapors, constructing acid-proof vessels and attending to many other details. Rather large amounts of capital had to be invested before an initial technical plant could be operated without difficulties.

In Germany, which is not producing sufficient agricultural carbohydrates for cattle food and which has a rather large supply of waste wood, this new industry may become an important factor in its economics. But it may also prove useful to the United States where the problem of disposing of the waste material in the cornfields, for instance, begins to be a serious question on account of the increasingly destructive activity of the corn-borer.

Obviously, the particular technical problems in every country have to be studied separately and there is no denying the fact that it takes perseverance, faith and a good deal of optimism, not to speak of time, for preparing and developing a new industry of that kind.
—*Friedrich Bergius.*

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These proceedings of the Fifth International Congress on Heredity embracing two large volumes form at the same time supplementary volumes I and II of the "Zeitschrift für Induktive Abstammungs- und Vererbungslehre." The majority of the papers submitted are printed in German, but others are printed in English and in French.

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RADIOVISION

THE amateur radiovision enthusiast will soon have at least twenty-one stations broadcasting such programs, located all the way from Lexington, Mass., to Los Angeles, Calif. These are operated by eleven different broadcasters. Nine are now broadcasting, while two have their stations under construction. Several others have applied to the Federal Radio Commission for authority to enter this field, but so far have neither been granted a license to operate nor a construction permit.

Included in this number are three of the chief manufacturing firms. The Radio Corporation of America, in New York City, has three bands of 100 kilocycles width each. One is now in use, while the other two are under construction. The General Electric Company, at Schenectady, N. Y., is regularly broadcasting on three different frequencies, including 790 kilocycles, that of the WGY broadcast station. These are all on 10-kilocycle widths. The Westinghouse Electric and Manufacturing Co., of Pittsburgh, Pa., has been assigned two bands of 100 kilocycles width, at wave-lengths of 63 and 150 meters. The former is now in use, but on an irregular experimental schedule.

Though the Federal Radio Commission has recently issued a new order regulating radiovision broadcasting, this does not affect the present situation very greatly. One of the chief points is that it may be done freely, though with the necessary approval by the commission, on frequencies above 1,500 kilocycles, or wave-lengths below 200 meters, the lower limit of the broadcast band. Radiovision broadcasting on frequencies between 550 and 1,500 kilocycles, the present band of the broadcast stations, will be permitted, with certain limitations. One is that no band wider than 10 kilocycles may be used for the purpose. Another is that it shall not be done more than one hour each day, and that it shall not be done between 6:00 and 11:00 P. M., in order not to interfere with broadcast listeners.

All the present radiovision broadcasters are now using the shorter wave-lengths, except the broadcasting stations WGY, WRNY, WCFL and WIBO. None has bands wider than 10 kilocycles, as that is the width of all sound broadcasting bands. Of these stations, only WRNY has been broadcasting radiovision in the evening hours, so that appears to be the only station even slightly affected. However, the radio commission has announced that there will be further reallocations of the radiovision bands. It is believed that this action will be to limit all broadcasters to a very few bands, of 100 kilocycles each, and let them divide the time. In view of the limited power of most of these stations, and the fact that none broadcasts more than a short time daily, the necessary time division should be worked out to the satisfaction of all.

The Radio Manufacturers' Association recently adopted as standard the 48-line, 15-picture-per-second method, with the scanning across the frame from left to right and top to bottom, as one reads the pages of a book in English. Though some of the broadcasters have not yet adopted this standard, four are now using it and probably more will follow. Some of the stations are using fewer lines, or fewer pictures per second. This is done in an effort to get more varieties of light and shade in the limited bands now assigned. With the 100 kilocycle band that will be used in the future, ten times the width used by many present broadcasters, it will be possible to send considerable detail with the 48 lines and fifteen pictures a second.

Even the highest pitched sounds ordinarily heard are below 5,000 vibrations a second, and so may be sent satisfactorily in the present broadcast band. With radiovision, however, the number of vibrations required per second may be many times as great. Hence it requires a wider band. If the number of vibrations is cut by limiting the number of lines to the picture there is loss of detail, or if the number of pictures per second is lower, there is an objectionable flicker.

THE ERUPTION OF ETNA

AN eruption of Mount Etna, in Sicily, such as the one which broke out a few days ago and is still in progress, is more spectacular than dangerous, says Dr. Henry S. Washington, of the Carnegie Institution, the eminent American volcanologist. Dr. Washington has spent much time on the slopes of the volcanoes of the Mediterranean region, and knows Vesuvius and Etna with especial intimacy.

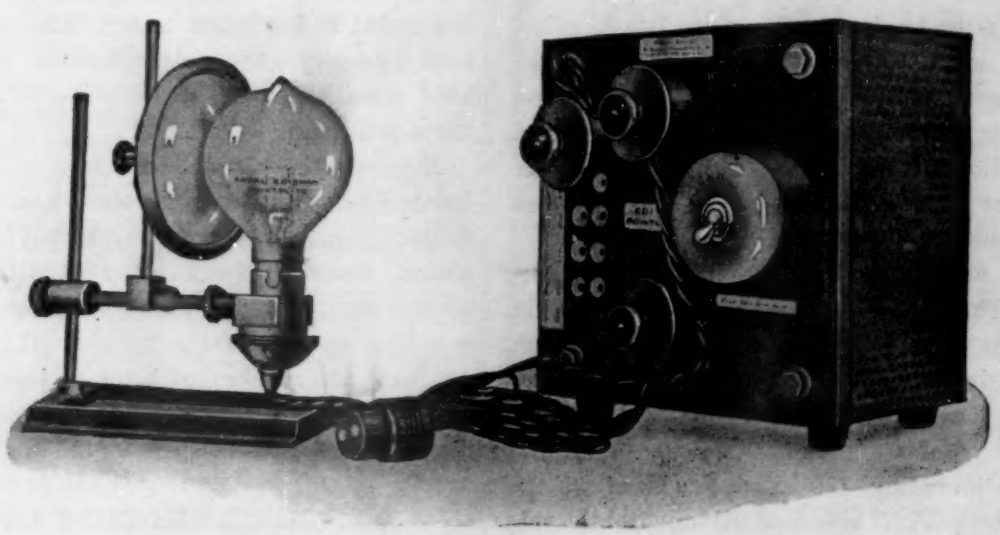
"Etna's eruptions have always consisted almost entirely of relatively quiet flows of lava," he stated in an interview to *Science Service*. "The violent steam explosions that characterized the eruption of Vesuvius when ancient Pompeii was destroyed, and in modern times made Pelee's outburst so terrible to the inhabitants of Martinique, are quite foreign to the Etna type of volcano. The clouds of "smoke" rising from Etna at present are merely incidental; they look ominous but contain no real menace.

"Lava flows, such as the present one, are frequent occurrences on Etna. They come every few years, and the inhabitants are used to them. They get out of the way until they stop, and it is very seldom that anybody is killed."

The non-explosive character of the Etna eruptions, Dr. Washington explained, is due to the chemical nature of the lavas. Etna lavas are mostly basaltic rocks. These, when melted, become a relatively thin and easy-flowing liquid, which permits steam and gas to bubble through and escape. The acidic lavas of the more explosive volcanoes, on the other hand, are thick and viscous, and hold steam more stubbornly, until enough force is piled up to cause a violent blow-off.

Whether the present outbreak of Etna will develop into a major eruption it is too early to tell. The two greatest lava flows of the Sicilian volcano in modern times took place in 1536 and 1852, according to Dr. Karl Sapper, leading German student of volcanoes. Old records tell of eruptions as early as 475 B. C.

Because Etna is the greatest volcano in the Mediterranean region, it was regarded by the people of classical antiquity as the chimney of Vulcan's forge, where the thunderbolts of Jupiter were hammered out. The name



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of the lame blacksmith-god thus became the generic title for all fire-mountains; all volcanoes belong to Vulcan.

DISEASE IN INDUSTRY

NERVOUSNESS or nervous diseases are a frequent cause of sickness absence in industry, according to studies made by Dr. Millais Culpin, of London Hospital. Apparently these conditions have little or no relation to the work or working conditions.

Seven of the first twelve cases on the annual sickness records of one large firm showed losses ranging from 94 to 278 days because of nervous diseases. These latter were listed as nervous breakdown, nervous exhaustion, dyspepsia and nervous debility, heart and nervous overstrain. In this particular firm, the workers are reasonably well paid, working conditions are hygienic and the workers are not driven at their work. In firms where the conditions are less pleasant and the work is strenuous, the absence rate for diseases of this type is lower.

Dr. Culpin likens this type of nervousness to that which appeared as shell-shock during the war. Its basis is emotional, not physical, although the physical symptoms are very real to the patient. The worker's liking for his work plays a large part in determining the amount of absence due to nervous trouble. Among many workers examined, those who liked their work had very few absences due to their nervousness, even though they showed on examination the same kind and degree of nervous disease as workers with many absences who disliked their work. In the latter type the nervousness became the means for emotionally unstable people to escape an unpleasant situation.

If nervous people were forced to work or starve, many would work and be saved from nervous breakdown to which they otherwise succumb. Others would starve and some might find a speedier end.

A SEVEN-INCH HUMAN TAIL

A HUMAN tail of almost record-breaking length has just been discovered appended to a baby girl born at Knoxville in Tennessee, the state that outlaws evolution. This tail was reported to be seven inches long. The record is a nine-inch tail on a twelve-year-old boy from French Indo-China.

Only about twenty-five authentic cases of babies born with tails are known to science. However, every human being, including the late William Jennings Bryan, had a tail at an early stage of his life, according to Dr. Adolph H. Schultz, associate professor of physical anthropology at the Johns Hopkins University and research associate of the Carnegie Institution of Washington. Dr. Schultz has asked that the unique appendage be sent him for study.

Before birth, when man is in the embryo stage of his life, he has a tail one-sixth the length of his body. Generally this tail disappears before birth, though the rudiments of the vertebrae in it may be found in man's spinal column, where they are known as the small bones of the coccyx at the end of the spine. Occasionally the tail persists and appears externally, as in the case of this new daughter of the Fundamentalist state.

Man's evolutionary relatives, the higher apes, have even less of a tail than man himself, Dr. Schultz said. In the orangoutan the embryonic tail disappears more completely, leaving only two or three rudimentary tail vertebrae. In man there are four or five of these and sometimes six at the base of the spine.

When the tail persists externally, it has no bones, but is made up of nerves, blood-vessels and muscles. In man and apes it is evidence of evolution from a tailed ancestor.

ITEMS

CLEANLINESS is the exception and not the rule in dairy establishments, Milton E. Parker said at the meeting of the American Public Health Association. Ordinary methods of cleaning leaves a film of oil and sometimes a rough deposit, known as milk-stone, on tanks, pipelines pasteurizers and other equipment. This occurs even when the washing compound used has the power of killing germs. However, killing germs is not enough, for if traces of milk are left on the equipment, there is a chance for more germs to breed and get into the next batch of milk. Failure to clean thoroughly is the fault of the washing compounds in general use. Mr. Parker reported the results of experiments made with several alkali compounds and recommended crystalline tri-sodium phosphate as the most satisfactory for really cleaning dairy equipment. However, this alkali should not be mixed with carbonate or bicarbonate.

WHEN colds "run in the family" it is no sign that the family is constitutionally subject to colds. It may be that some member of the family is acting as a carrier, just as some people are typhoid carriers, suggests Dr. P. Watson-Williams in a report to *The Practitioner* of observations made on ninety consecutive patients. Sometimes one child is known for starting colds among his brothers and sisters. This same child may become immune to colds himself but still harbor cold germs and be able to pass them on to others. If he grows up and has a family, he may still be starting colds in the family, although they are no longer traced to him. The reason for this may be an unsuspected infection of his nasal sinuses, the honey-comb structures back of the nose and eyes. This same infection may be the reason for some children growing a second set of adenoids, when the first ones have been removed with the tonsils.

EVENTUAL propulsion of aircraft by motors operating on heavy oil fuel and self-igniting, on the Diesel principle, is forecast by experiments made by the Junkers aircraft concern. Experimental engines radically different from the ordinary powerplants of airplanes are understood to be under test and to have actually flown. The Junkers firm pioneered in all-metal aircraft and their airplanes to-day are different in appearance from the common type.

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SCIENCE NEWS

Science Service, Washington, D. C.

CHEMISTRY ALTERS INTERNATIONAL RELATIONS[1]

By Dr. Edwin E. Slosson

Director, Science Service

When I speak of the new field of chemical industry as the synthetic kingdom I have in mind something more than the mere fact that it consists in making new combinations of the chemical elements. It also makes new combinations of industries and brings together different countries as well as chemical elements. As the synthetic kingdom overrides the traditional dividing lines between animal, mineral and vegetable, so also it overrides the traditional boundary lines between the nations. It brings international competition which naturally results in the end in international cooperation. This modern development of chemistry has strong political consequences. It promotes national independence and at the same time breaks down natural monopoly.

Twenty years ago it could be said that Chile had a natural monopoly of the world supply of nitrates, but that monopoly has been broken in two ways: by the utilization of the nitrogen from coal through the preservation of its by-products, and by the utilization of the nitrogen of the air through fixation. An impartial providence has endowed every nation with a supply of nitrogen exactly proportional to its area. Whether this free nitrogen is utilized or not in any particular country depends not upon natural resources but the ability of its people. Brain-power, like water-power and coal-power, is very unevenly distributed among the nations.

The effect of the synthetic régime in short circuiting natural processes and multiplying the resources of raw materials has brought industries and countries into unexpected competition. The chemist has upset the geography that we learned in school. For when we were children the natural products were duly distributed among various countries by what was assumed to be the immutable law of nature. To impress this upon our youthful minds we had pictorial maps showing the sources of the substances that were consumed in our daily life: a rubber tree in Brazil; an indigo plant in India; a cotton plant in Carolina; a camphor shrub in Japan, and a silkworm in China. The chemist has ruthlessly uprooted these neat emblematic labels. The United States may ship indigo to India. If the motion picture magnate finds that Japan is charging him too much for the camphor for his films he may buy it from Germany where it is made from American turpentine. The silkworm of Japan and the cotton plant of Carolina are hard pushed by the competition of the wood pulp of Sweden.

The new synthetic kingdom of which the chemist is king and founder already overlaps and may ultimately embrace the three traditional kingdoms of nature. In the present transition state while the new régime is being established the attempt to classify products according to the old divisions is causing considerable confusion. Does a given sample of butter come from a cow or a coconut? Does a given sample of sugar come from beet or cane? Does a given sample of alcohol come from grain or wine? Does a given sample of acetic acid come from cider or malt? Does a given sample of rubber come from forest or plantation? Does a given sample of musk come from seeds of hibiscus or glands of deer? Perhaps neither; for, perchance the butter and sugar, the alcohol and the vinegar, and the rubber and the perfume may have come from coal. Nobody knows but the chemist who made it and maybe he won't tell. Anyhow, it's nobody's business if the chemist has done his business well enough so the product is correct. After a compound has come under the domain of the chemist, it has renounced all allegiance to the kingdom of its natural origin.

[1] Address given before the Second International Conference on Bituminous Coal, Pittsburgh, Pennsylvania.

THE COMMERCIAL PRODUCTS OF COAL

Soap fats, edible fatty foods, lubricating oils, gasoline, kerosene, light and heavy oils, and anti-knock motor fuel of high value are among the commercial products that coal has been made to yield through the skill of the chemists of the German Dye Trust in their research laboratories and immense plants at Leuna, Ludwigshafen and Oppau in Germany.

Seldom does information concerning their new chemical achievements emerge from the carefully guarded walls of this great industry, but before the Second International Conference on Bituminous Coal, Dr. Carl Krauch, director of the I. G. Farbenindustrie Aktiengesellschaft, discussed the mechanism of catalysis and hydrogenation, the chemical processes that have allowed the production of such diverse and valuable materials from coal as raw material.

The synthetic chemical production of basic materials from coal is of utmost importance to Germany's economic future. That country is made practically independent of parts of the world that have prospered from monopolies of rich natural resources. But the German research has immediate application to American conditions. The president of the Standard Oil Company of New Jersey, Walter C. Teagle, introduced Dr. Krauch and in his address the German chemist revealed that the dye trust processes, controlled in America by the Standard Oil Company, can be used effectively in the refining of crude oil.

Refined by the catalytic process, crude Mexican oil, containing 5 per cent. of sulphur, produces gasoline with only a small amount of this undesirable element. Catalysis and hydrogenation also allow the refinery to make from crude oil the material bringing the highest market price. Gasoline, kerosene, gas oil, lubricants and other

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EXPERIMENTAL PHYSICS. Albert E. Caswell. pp. ix + 181.

Though this manual may be used in any course in general physics, it is intended especially to accompany the author's text-book "An Outline of Physics." Very little in the way of special apparatus is called for.

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products can be produced in quantities varying with the catalysts used. Research applying these new German developments to American refinery practice is understood to be under way in Baton Rouge, Louisiana.

At the Leuna chemical plant in Germany, an annual production of 70,000 tons of synthetic gasoline has been achieved and by the end of 1929 it will equal 250,000 tons. The processes used in this and the other synthetic productions are combinations of catalytic methods developed by the I. G. chemists and the hydrogenation methods developed by Dr. Friedrich Bergius, the German chemist, whose patents were acquired last year by the German Dye Trust.

The close resemblance that synthetic gasoline and other products obtained in the hydrogenation of coal bear to their natural counterparts suggests to Dr. Krauch a new theory of the origin of crude oil.

"Peat and coal layers, after getting into greater depths, combine with hydrogen under pressure, thereby being partially converted in liquid hydrocarbons," said Dr. Krauch. "The presence of hydrogen in the interior of the earth is deduced from the fact that both rocks and volcanic gases contain it. Apart from the generally accepted views of its formation, its origin might be attributable also to the action of water vapors at high temperature upon coal."

The basis of catalysis, the chemical phenomenon that causes two substances to react more effectively in the presence of another that does not undergo chemical change, is believed by Dr. Krauch to be electromagnetic. He conceives the molecules and atoms as having two poles like a bar magnet. The catalytic agent places them under an electric spell and makes them more receptive to chemical action.

Credit was given by Dr. Krauch to American chemists for the fundamental theoretical research upon catalysis. Discoveries by chemists of this country were often used in making the industrial application in Germany.

LIQUID FUEL

SETTING the Thames afire is one of the proverbial impossibilities; yet the householders and factory owners of the future will be doing exactly that when they light up the fluid fuel in their furnaces.

This, in effect, was the prophecy of A. T. Stuart, consulting engineer of Toronto, made to the conference. He based his look ahead on the ever-increasing use of liquid and gas fuels in industrial and domestic power and heating plants, and on the increasingly practicable processes for converting coal and other solid fuels into fluid forms.

The essential of making coal into a liquid or gas fuel without waste is the adding of hydrogen to its carbon. Hydrogen is obtained commercially by breaking up water with electricity. "Hence," said Mr. Stuart, "it is not unlikely that more water than coal will be used as raw material and that perhaps half of the energy of future fuel will come from the combustion of hydrogen obtained originally from water."

Water yields oxygen as well as hydrogen when it is broken up, and the disposal of the surplus of oxygen will present considerable engineering problems. Some oxygen can be combined in the fuel-making process, but a great deal will be left over. The best disposal of this will be to find some place in the process where it can be separated out, and dispose of it as a commercial gas.

Water-power sites and coal mines will not be looked upon as rivals when the fluid fuel economy of the future has been worked out. The most efficient means for breaking up the water to get its combustible hydrogen is to be found in the electricity generated by hydroelectric plants, which already have far higher capacity than the market justifies. This is because their market at present makes use of their maximum production during only a part of each day—the so-called "peak load" period. But if the power can be used for the generation of hydrogen and oxygen from water during the slack periods, the plants can be run at full efficiency continuously; and what was originally water-power will appear, sometimes at long distances, as fuel-power.

POWER FROM THE SEA

AN engineer working on an invention that will not be any good until a couple of centuries after he is dead, but will be urgently needed then—such was the phenomenon which was presented by M. Georges Claude. And M. Claude was not directly concerned with coal at all, but with what the world will do for power after the coal is all burned.

He proposes to harness the potential power involved in the difference between surface and bottom temperatures in the sea. The array of eminent chemists, engineers, inventors and industrialists who heard his address listened with respect, because the speaker's record was not that of a mere visionary. M. Claude invented the first successful process for making liquid air and liquefying other gases; he pioneered in the field of making ammonia out of the atmosphere; he is the inventor of the glowing neon lights that shine on our street signs at night.

The difference between surface and bottom temperatures in the sea, which M. Claude proposes to turn into kinetic energy, is not great. Bottom temperatures hover near the freezing point of water; surface temperatures are only thirty or forty degrees above them. This is only a fraction of the temperature difference utilized in the ordinary steam plant, where the degrees are counted by hundreds instead of by tens. M. Claude proposes, however, to get around this by exhausting the air from his boiler. In the vacuum thus created water will boil at very low temperatures, provided the vapor thus generated is removed fast enough and condensed after being passed through a turbine. A working model of such a hydrothermal plant has been built by M. Claude and his associates, which has been successfully demonstrated before a number of scientific bodies in both Europe and America.

LAVA FLOWS AND VINEYARDS

Now that the eruption of Etna shows signs of subsiding, we may expect the inhabitants of the evacuated region to move back to their devastated farms and vine-

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For the best memoir presented a prize of sixty dollars may be awarded; if, however, the memoir be one of marked merit, the amount may be increased to one hundred dollars, at the discretion of the Walker Prize Committee.

For the next best memoir a prize not exceeding fifty dollars may be awarded.

Prizes will not be awarded unless the memoirs presented are of adequate merit.

The competition for these prizes is not restricted, but is open to all. It is nevertheless the tradition of the Society that the founder of these prizes intended them more in the nature of encouragement to younger naturalists than as rewards for the work of mature investigators.

Attention is especially called to the following points:

1. In all cases the memoirs are to be based on a considerable body of original and unpublished work, accompanied by a general review of the literature of the subject.

2. Anything in the memoir which shall furnish proof of the identity of the author shall be considered as debarring the memoir from competition.

3. Although the awards will be based on their intrinsic merits, preference may be given to memoirs bearing evidence of having been prepared with special reference to competition for these prizes.

4. Each memoir must be accompanied by a sealed envelope enclosing the author's name and superscribed with a motto corresponding to one borne by the manuscript, and must be in the hands of the Secretary on or before March 1 of the year for which the prize is offered.

5. The Society assumes no responsibility for publication of manuscripts submitted, and publication should not be made before the Annual Meeting of the Society in May.

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SUBJECT FOR 1930:
Any subject in the field of Ornithology

FRANCIS HARPER, *Secretary.*

BOSTON SOCIETY OF NATURAL HISTORY, Boston, Mass., U. S. A. November, 1928.

yards, and to begin the slow reconquest of the land inundated by rivers of stone.

We need not exclaim in surprise over the Sicilian peasant's tenacious determination to stick to his ancestral acres, said Dr. Henry S. Washington, of the Carnegie Institution, in an interview with *Science Service*. He goes back into what looks like a danger zone for the same reasons that southern farmers went back to the lands flooded by the Mississippi as soon as the waters subsided: partly because it is his home and he has nowhere else to go, and partly because the land is very rich and repays cultivation in spite of occasional violences of nature.

The slopes of volcanoes afford the best vineyard lands the world knows. Not only in Italy, where grapes are cultivated on the flanks of still active volcanoes, but also in the famous grape areas of northern France and southern Germany, do we find vines on lava soils. The French and German vineyard districts are in very ancient volcanic areas where the earth-fires have long since gone out.

Lava flows sometimes play very strange tricks. The inhabitants of Catania, the largest town in the immediate vicinity of Etna, still firmly believe that their city was saved from the great flow of 1669 by a miracle. When the fiery river was sweeping down, they went to meet it in a solemn procession, bearing with them their most precious religious relic, the veil of St. Veronica. The lava turned aside and poured into the sea, and the town stood safe.

At another place, the owner of a villa about to be overwhelmed in despair sold the place to a bystander, who must have been a born gambler, for a trifling sum. No sooner had the bargain been made than the lava stream divided into two parts, cutting off a corner of the garden but sparing the house.

During an eruption of one of the Hawaiian volcanoes the owner of a sugar mill saved his building by a desperate resource. He had watched the flow, which at that place was very thick and viscous, slowly creeping closer and closer to his plant, thrusting out blunt, fiery "toes" of lava. In a gesture of impotent rage, he dashed a pail of water on one of the "toes," and to his astonishment it instantly "froze." Immediately he set all his hands to work with pails of water, freezing each new "toe" as it formed, and finally built up a protecting dike out of the lava front itself, turning the main stream aside down a gully.

Dr. Washington has spent a lifetime studying volcanoes in all parts of the world, but he has made the Mediterranean region, and especially Italy, his particular field. In recognition of his work he has been decorated by King Victor Emmanuel with the Order of the Crown of Italy.

ITEMS

INSECTS that combine certain characteristics of both sexes have been produced by Professor James W. Mavor, of Union College, Schenectady, N. Y. Professor Mavor exposed fruitflies to the action of X-rays, and among the other evolutionary changes appearing in their offspring were these strange "sex intergrades." He was one of the first biologists to obtain genetic changes in living organisms by treating their germ cells with X-rays. These are brought about, he says, by shifting the positions of the chromosomes, which are the specialized bits of protoplasm believed to be the bearers of hereditary characters. He expresses some doubt as to whether it is possible to produce changes by dislodging or rearranging individual "genes," or hereditary units, without also affecting the whole chromosomes. The idea of delicate control over the course of evolution is not accepted by Dr. Mavor. He believes that the X-rays hit the germ cells too indiscriminately. "There is no question of X-rays controlling the processes of heredity any more than a train-wrecker controls transportation."

SCARLET FEVER is at the top of the list of communicable diseases reported to the U. S. Public Health Service this week. Telegraphic reports for the week ending November 10 from all but four states show that there are 2,841 cases of this disease in the country, an increase of nearly 700 cases over last week. Diphtheria, influenza and measles follow in the order given, with 2,181, 1,442 and 1,373 cases, respectively. Infantile paralysis, which threatened to become epidemic a few weeks ago, is now at a safe low level. Only 98 cases were reported. The rise in scarlet fever, diphtheria and influenza is about what is expected at this season of the year.

A TRITON, one of the lower vertebrates related to frogs and salamanders, has been induced to grow a new foot on an unmutilated leg already provided with a foot. At a recent meeting of the Russian Academy of Sciences, Dr. N. N. Nassenow described his experiments. It is nothing new for a triton to grow a new foot, or even a whole new leg. Tritons seem to be able to regenerate very considerable parts of their anatomy, even including such complex organs as eyes. But hitherto they have done so only when through accident or surgical operation something was cut or bitten away. In Dr. Nassenow's experiment no cutting took place. He merely put a bandage around the creature's leg, tight enough to put pressure on the tissues but not tight enough to injure them severely. Some time thereafter, a swelling was noted on the triton's leg, which subsequently grew out into a normally formed foot, alongside the one already normally present.

THE new British Embassy being constructed at Washington, D. C., will contain a new heating system which eliminates all radiators. The rooms are heated by small hot water pipes buried in the walls, ceilings and floors. The system is in use in England but never before has been installed in an entire building in this country. In some of the rooms the entire walls and ceilings will be heated by the pipes, and in others the floors will be warmed. This system was finally decided upon by the British officials in order to do away with all visible radiators and other heating devices.

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GRAND CENTRAL TERMINAL, NEW YORK, N. Y.

SCIENCE NEWS

Science Service, Washington, D. C.

ANTIRACHITIC FOODS

"SYNTHETIC cod-liver oil," stuff that builds bones and prevents the childhood disease of rickets without the unpleasant taste of the fish oil, was recognized when the 1928 Nobel prize for chemistry was awarded to Dr. Adolf Windaus, of Göttingen, Germany. This is the first time that the Nobel Prize Committee has recognized any of the scientific work done on the problems of human nutrition.

The work for which Dr. Windaus received the prize was the successful repetition of experiments proving that ultra-violet light, either in the sunlight or artificially produced, will activate the chemical called ergosterol and confer on it antirachitic properties. According to information available, the experiments were originally performed by Professor George Barger, of the University of Edinburgh. Dr. Windaus was so impressed by Dr. Barger's original results that he asked permission to collaborate with Barger in subsequent work on the problem. Windaus himself had been experimenting along similar lines without achieving definite results.

A scientific controversy may arise from this Nobel prize award since priority honors and patent rights are involved in the situation. While the prize was awarded to Dr. Windaus, the subject of the antirachitic properties of foods has engaged the attention of scientific investigators both in this country and Europe for many years. The work along these lines began when Dr. E. V. McCollum and his associates at the Johns Hopkins University found that a substance, known as vitamin D and found in cod-liver oil and to a lesser extent in other fats, has the power of preventing rickets. These scientists also were the first to find that irradiating animals by exposing them to ultra-violet rays would keep the animals from having rickets even if the antirachitic vitamin D was not in their diet.

The next step was taken by Professor Harry Steenbock, of the University of Wisconsin, who instead of irradiating animals tried irradiating their food. He worked with a mixture of foods and found that irradiation gave to the foods the antirachitic power. Commercial production of irradiated foods is now in progress under the Steenbock patent. Dr. Alfred E. Hess, of Columbia University, irradiated the different classes of foods separately and found that the antirachitic substance was contained in fats. He and every one else believed for some time that it was the cholesterol of fats that was the antirachitic substance.

Then in July, 1926, Dr. Barger and his associates in England announced that pure cholesterol can not be activated by ultra-violet rays, but that irradiation does activate ergosterol which is found as an impurity in ordinary cholesterol not purified by a special process. They believed ergosterol had the antirachitic property. Dr. Windaus repeated their experiments, and again tested cholesterol which had been specially purified. He proved definitely that it is ergosterol and not cholesterol which is activated by exposure to ultra-violet light. Dr. Barger and his associate, Dr. T. A. Webster, have also proved by experiments with animals that this activated ergosterol can prevent rickets.

ARTIFICIAL COAL FROM WOOD

CELLULOSE and lignin, the two principal constituents of wood, have been converted into artificial coals practically identical with natural coal found ready-made in the ground, according to an announcement made by Dr. Friedrich Bergius, of Heidelberg, Germany, to the Second International Conference on Bituminous Coal. In 1926 Dr. Bergius at the first coal conference told how he had made synthetic gasoline, oil and other products out of coal and since then the German Dye Trust has utilized his process for producing commercially thousands of tons of synthetic motor fuel.

During theoretical researches upon the constitution of coal conducted from 1910 to 1913, Dr. Bergius first transformed cellulose into coal on a laboratory scale. This accomplishment led to the hydrogenation of coal under high pressure and during the fifteen years of developmental work upon this process further theoretical work on coal formation was not undertaken. In the past year, however, Dr. Karl Schoenemann, of the Bergius laboratory, has manufactured several pounds of the artificial coal from cellulose and smaller quantities from lignin. Chemical analysis and conversion of the artificial coal into products similar to those produced from natural coal have convinced Dr. Bergius that the substance made from the wood elements is a real coal.

Making of coal from wood and the production of oil from coal provide hints of the processes leading to the formation of these substances in nature.

COLOR SNAPSHOTS

THE amateur photographer will soon be able to make snapshots in natural colors, in his own film camera, and without the need for exposures much longer than he would give with ordinary films. This is the announcement made in *Nature* by F. J. Tritton. These color films will be on the market within a month or two.

A triple film makes the new method possible. It forms what is known as the "tripack." In any process of color photography that reproduces all the colors of nature, it is necessary to make separate records of the reds, the greens and the blues in the original scene. One of the first methods of doing this was to make these photographs separately, first exposing a plate through a blue glass filter, which passed only the blue light, and so gave a record of the blues. Similar pictures, on separate plates, were made with green and red filters. By making transparent prints from these, dyeing each with the proper color, and then combining them, a color picture could be obtained. As the separate color pictures had

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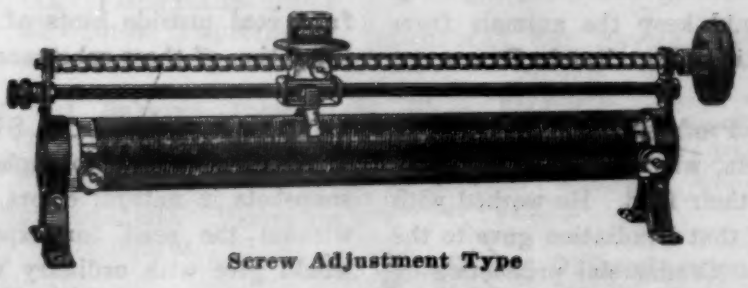

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to be made one after each other, the method could not be used for pictures of moving objects, though it is generally used to-day for making color reproductions in magazines.

With a tripack, three films are used at once. They are really arranged as a sandwich, two films with another between. The front one, in the new method, is sensitive to the blue light; the green and red pass through; the middle one is sensitive to the green, and the red passes through to the back one. Though tripacks have been used before, previously it was necessary to put the red in front and the blue in back. As the blue image is the one chiefly responsible for determining the outlines of the subject, and as the back picture is not as clear as the front one, there was more or less fuzziness of the finished picture. By putting the blue in front, a much sharper picture is obtained.

Mr. Tritton stated that this film could be made with very fast emulsions, so that these color films might be as fast as the average roll film. This would permit color snaphots in ordinary light, and with ordinary cameras, a thing not possible with other methods. As the finishing and printing of the pictures is rather complicated, it is probable that the manufacturers will provide this service.

THE GREAT SMOKY MOUNTAINS NATIONAL PARK

THE northern wild turkey, *pièce de resistance* of the Pilgrims' first Thanksgiving Day feast, may be saved from threatened extinction in the Southern Appalachian region by the establishment of the Great Smoky Mountains National Park. At present, well-informed natives of the region admit, this most typically American bird is being gravely over-hunted and has reached a point of distressing scarcity. Game laws do not afford it the protection they should, because many of the native hunters calmly disregard them, and also because there are not enough game wardens to keep track even of the "city" hunters who come in from the outside.

The hope that a national park, with its absolute prohibition of all shooting, backed by an adequate ranger force, will bring an increase in the depleted stocks of game is based on the results of the establishment of similar game sanctuaries in the national parks of the West. Yellowstone National Park, for instance, has been the salvation of the remnant of the American elk. There are now over 20,000 of these animals in the Yellowstone region, and the problem now faced by the game-conserving forces there is not how to save the herd, but how best to dispose of the surplus animals.

Other animals which it is hoped will profit by the protection afforded by national park rules are black bear and Virginia deer. There are still a good many bear in the Great Smokies, but they receive rather too much attention from city hunters and have become so shy that the average citizen on vacation in the region never gets to see them. Deer have been shot out to a point where the herds are dangerously small and where the stock is declining in quality through lack of new blood and resulting inbreeding. Interested citizens on the Tennessee side are willing to bring in fresh stock from Pennsylvania or New England, where the deer are more plentiful, to improve the present herds. But such animals would only be shot, and until an area of complete year-round protection can be established re-stocking is of little value. But with the Great Smoky Mountains National Park once in actual operation, its boundaries will enclose a natural reservoir of game, within which the native birds and animals can increase and multiply, spilling over the border into areas where reasonable shooting will be permitted.

INFLUENZA AND OTHER COMMUNICABLE DISEASES

A GREAT increase in influenza is reported for the week ending November 17 as a result of the epidemics in California and South Carolina. From California 3,192 cases were reported by telegraph to the offices of the U. S. Public Health Service. In South Carolina there are 1,008 cases. The total for the whole country is now 5,017, an increase of nearly a thousand cases over the week before, when 4,175 were reported.

Because of the uncertain character of this disease and the little that is definitely known about it, it is impossible to predict what the future course will be. Prompt attention to all colds and coughs and isolation of all suspicious cases is advisable. Crowds are to be avoided when there is danger of an influenza epidemic, while plenty of fresh air, sunshine and nutritious food will help build up the body's resistance.

Other communicable diseases are following the usual cold weather course. Measles has increased in the last week from 1,661 cases to 2,679. Scarlet fever has also increased but has not yet reached the peak of the last two years. Meningitis has shown an alarming rise, nearly doubling the number of cases reported week before last. For the week ending November 17 there were 80 cases reported. The incidence of smallpox is also higher. The number of cases is 389, but this is still a little below the high points of the last two years.

Typhoid fever and infantile paralysis are dropping with the arrival of cold weather. Only 72 cases of infantile paralysis and 418 of typhoid were reported. Diphtheria is a little higher, 2,598 cases being reported. This disease has run an irregular course for the last two years. Preventive work among school children has done much to reduce the incidence of this disease.

ITEMS

HIT-AND-MISS methods of mixing paints will soon be replaced by mathematical methods when the results of an investigation into the strength of pigments used in making tints completed by the U. S. Bureau of Standards are put into practical use. The bureau has measured with the spectrophotometer the color value of 104 different mixtures of pigments combined with a standard color. The investigation has disclosed the exact strength and amount of a pigment that should be mixed with a standard color to bring a given result. The investigation is hoped to result in a numerical color value being given to each pigment instead of the mixture depending on more or less uncertain methods of comparing shades.

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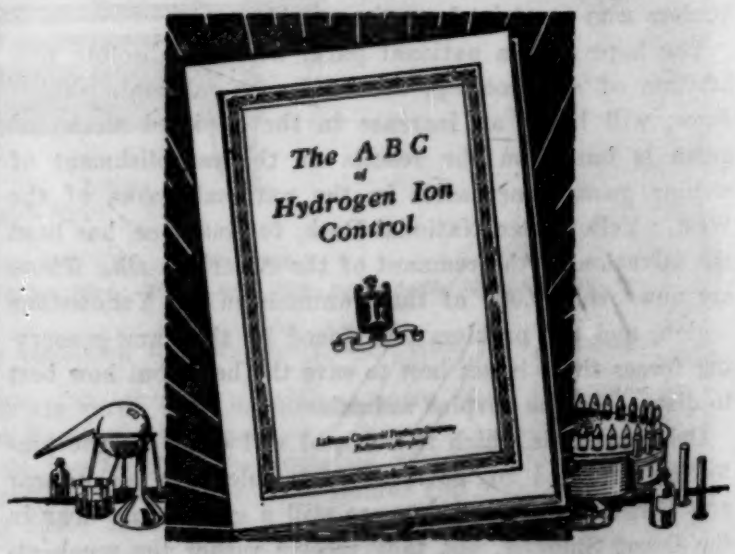

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SCIENCE NEWS

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RESEARCH ON COAL

THE elemental independence of modern man and his freedom from the accidental limitations of nature's distribution of natural resources under, on and above the surface of the earth was demonstrated at the Second International Conference on Bituminous Coal held under the guidance of the Carnegie Institute of Technology.

Oil from coal, coal from oil, coal from wood, edible fats from coal, rubber from coal, burnable gas from water, wood alcohol from coal, lubricants from coal, soap from coal, were a few of the possibilities, many of them practical commercial realities, that the coal conference reports added to the more familiar chemical processes of modern industry which now derive perfumes more fragrant than flowers, colors more varied than the rainbow, coke more useful than raw coal, gas more calorific than natural gas and a multitude of other every-day utilities from coal, wood, oil, air and water.

So rapidly is science discovering the secrets of the raw natural materials and their elements that these coal conferences might well be broadened into CHON conferences. Why not a synthetic name for the congresses that contribute so much new knowledge to the present era of the industrial transformations based on chemistry? The chemical symbol, C, for carbon contained in coal, wood and oil, H for hydrogen in hydrocarbons and water as well, O for oxygen most prevalent in the air, and N for nitrogen, four fifths of air, which is present in all living things and one of the principal constituents of fertilizer. These four chemical elements are the essentials of the vast fuel, coal, oil, wood, organic chemical, agricultural and food industries of the world as well as all forms of life. They exist the whole world over in some form or other. Every country has air and water, certain countries like the United States are blessed with bountiful supplies of easily available C as coal and oil.

From Europe, to this year's coal conference as to the first one in 1926, came the most ingenious and promising methods of converting coal into other things. Dr. Carl Krauch, German dye-trust chemist, told how, through the magic of catalysis and hydrogenation, coal is made into gasoline, lubricating oil, kerosene, paraffin, alcohol, fats and nearly any other hydrocarbon that the market may desire. Dr. Friedrich Bergius, the Heidelberg chemist whose hydrogenation process, first reported to the 1926 coal conference, is now used and controlled by the German dye trust, announced the conversion of the cellulose and lignin of wood into artificial coal, the process used by nature millions of years ago in the manufacture of coal. Dr. Fritz Hofmann, veteran German chemist, affirmed but did not explain the production of real rubber from coal. From France and other laboratories in Germany there came papers telling of intensive researching upon the vital problem of making from coal, which Europe has, the gasoline, lubricants and other products that must at present be imported. Necessity is the reason why this sort of research is more intense in Europe than in America. Our country, richer in natural ready-made products, has devoted its brains and energy to better methods of cracking its petroleum or burning its plentiful oil and coal.

It is significant and encouraging that much of the pure scientific research, the romantic delving into molecular and atomic love affairs, that formed the foundation of European industrial applications was done here in America. Professor Hugh S. Taylor, of Princeton, did much pioneer work on catalysis, in which one substance eggs on others to do something without being itself altered.

England has been more interested in the process of coal treatment known as low temperature carbonization. Instead of coking the coal at a high heat, as is done in the familiar by-product coke ovens of America, the volatile matter in the coal is driven off at a much milder temperature, preserving and producing more of the valuable liquid and gaseous products of coal. Low temperature processes are of great interest to America and, in fact, the largest low temperature carbonization plant in the world is now being erected in New Jersey.

Coal production in America has actually decreased in recent years due to the increased use of oil as fuel, F. G. Tryon, of the U. S. Bureau of Mines, reported to the conference. And the oil industry is borrowing the latest coal research developments to make its production more efficient. The German methods of liquefying coal have been brought to America and set to work getting a larger percentage of gasoline out of crude oil. A paradoxical development reported to the conference by Professor Walter F. Rittman, of the Carnegie Institute of Technology, was the actual commercial production of artificial bituminous coal from crude oil residues as a by-product of the production of gasoline.

Since large amounts of raw coal will still be burned despite the new treatments and transmutations that are possible, new combustion methods are being developed. Pulverized coal has propelled its first sea-going vessel, the *S. S. Mercer,* C. J. Jefferson, of the U. S. Shipping Board, and Commander J. J. Broshek, of the U. S. Navy, told the conference. In Germany an internal combustion engine of the Diesel type has been built to feed on powdered coal and abroad locomotives fired by coal dust draw trains. Great power plants are being built here and abroad to use the finely divided state of coal.

For power production coal or other combustibles are not a necessity as hydroelectric plants have demonstrated. To the coal conference was reported a power production method that promises to be another fuel competitor. Georges Claude, the French scientist, whose name and genius is associated with ammonia synthesis, liquid air and neon lights, proposes to tap energy of the sea, the temperature falls of the ocean. In Belgium a power plant of sixty kilowatts runs on the temperature drop of thirty-three degrees Fahrenheit. In the warm tropical

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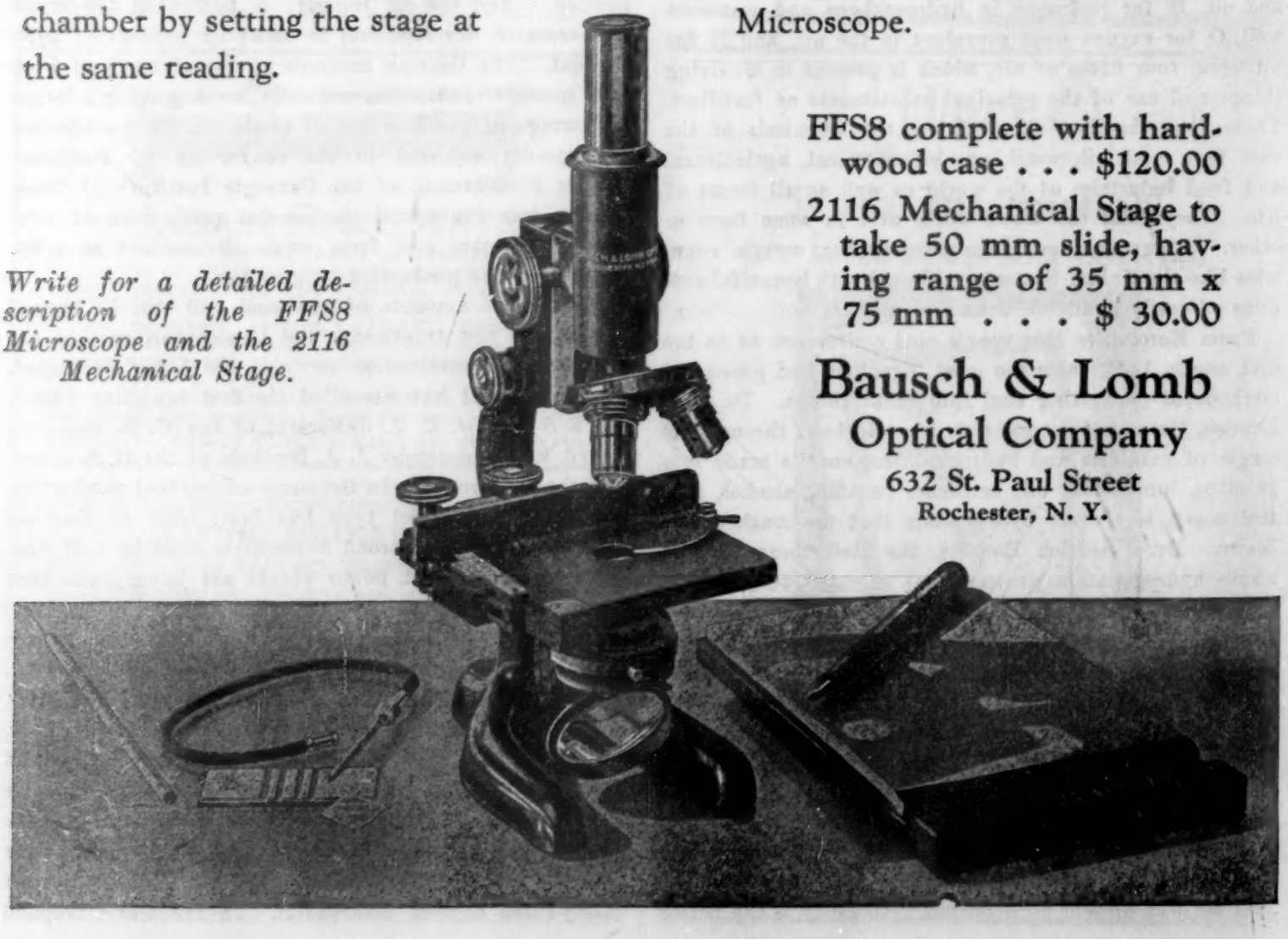

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waters of Cuba whose depths are always cold, he proposes to build a larger power plant utilizing the free power of the sea's temperature difference. Eventually he foresees Florida and southern California benefiting from his new invention.

The two years since the first Carnegie coal conference, as summarized in the papers presented this year, exceeded in achievement even the prevision of Dr. T. S. Baker, president of the Carnegie Institute of Technology, whose planning and energy made possible the international conferences. The effects of such vigorous world congresses upon world industry can not be properly appreciated contemporaneously, but the 1,800 representatives of twenty nations attending will take back to their plants and laboratories new ideas and enthusiasms. Those attending the conferences can not help but feel that the prosperity of CHON industries are fully as dependent on science as on economics, if not more so.

An important by-product of the coal conference should be a growing realization that rampant nationalism is as obsolete as the open-coal grate. Wars, always wasteful, need not be fought for raw materials. All nations have them in some form. Scientific conquests are more lasting than military successes. At the coal conference Germans, French, English and Americans worked together. The genius of discovery and research in any part of the world in these accelerating days soon conquers the whole globe.—*Watson Davis.*

THE MALAYSIAN ECLIPSE

ASTRONOMERS from the U. S. Naval Observatory in Washington and from the Sproul Observatory, Swarthmore, Pa., will join with colleagues from Germany, England, Italy, France, Holland and Australia, in observing the eclipse of the sun visible in this part of the world next May. It will be the best eclipse in recent years, and will occur in the afternoon of May 9. The path of totality, along which falls the shadow of the moon and in which the disc of the sun will be completely obliterated for a few minutes, begins to the east of South Africa, in the Indian Ocean. From there it passes in a northeast direction to the Malay Archipelago, where it first touches easily accessible land.

In Malaysia it crosses the northern end of Sumatra, then the Malay Straits, the southern part of Siam and the northern part of the Malay Peninsula, the Gulf of Siam, Cochin China, the South China Sea, and some of the southern Philippine Islands. The largest of these are Palawan, Panay, Negros, Cebu and Leyte. Then it passes into the Pacific Ocean where it ends.

Though along part of its path the eclipse lasts 5 minutes and 7 seconds, this part is out in the Indian Ocean. The Simeuloe Islands, west of Sumatra, are nearest to the maximum, where the total eclipse will last nearly that long. In Sumatra, it will last five minutes, and in the Philippines about three and a half minutes.

Captain C. R. Freeman, of the U. S. Naval Observatory at Washington, has announced that their expedition will go to Iloilo, on the island of Panay. This is one of the largest towns in the path of totality. It has about 50,000 inhabitants and is provided with banks, hotels, machine shops and other features which visiting astronomers may need. Telegraph, radio and telephone connections will enable the outside world to be informed promptly of the outcome. The Panay and Negroes Telephone Company supplies most of the towns in this part of the path, and the company has offered the free use of its lines to visiting astronomers. Dr. R. L. Waterfield, of the Johns Hopkins University, is also planning to observe it from Iloilo.

The Sproul Observatory, under the direction of Professor John A. Miller, who has observed more eclipses than any other astronomer, will send a party to Sumatra. There will also be a Dutch expedition in Sumatra as well as one from Australia. A German party from Potsdam will go either to Sumatra or Siam. There will be two British groups. One, from Greenwich, will go to Alor Sta, in Kedah, in the Malay Peninsula. The other, from Cambridge, will make its headquarters at Pattani, in Siam. There will be a German party, from Kiel, in Siam, at Khoke Rhode. A third German expedition, from Göttingen, has not yet announced its site, while a fourth, from Hamburg, will be neighbors of the U. S. naval astronomers at Iloilo. A French party will go to Cochin China. There will also be one from Italy, but their location is still unknown.

Perhaps the most important observations to be made will be the photography of the corona. This is the outer part of the sun, and though extending for as much as a million miles from the sun's surface, is ordinarily invisible because of its faintness. Only when the opaque moon obscures the bright globe of the sun does the corona flash out. An eclipse of the sun can not possibly last more than 7 minutes and 40 seconds. Most are much shorter, and as one that can be satisfactorily observed occurs on the average only once in several years, the astronomers make the most of their opportunities of observing this important part of the sun. Other observations will be made of the flash spectrum, at the beginning or end of an eclipse. This gives important knowledge of the outer layer of the sun, the "chromosphere." The English astronomers will also observe the "Einstein effect." This is the deflection of the light of stars as they pass the sun, and can only be observed during a total eclipse. This is one of the experimental proofs of the Einstein theory of relativity, and though it was found to exist at eclipses in 1919 and 1922 further evidence is desirable.

BLOOD CHEMISTRY AND DRUG ACTION

THE effect of a dose of medicine depends not merely on the chemical make-up of the medicine itself, but on the chemical state of the blood in our bodies when we take it. This is indicated by the experiments of Dr. William Salant, of the University of Georgia Medical School, performed here and at the Cold Spring Harbor Biological Station on Long Island.

The blood of all warm-blooded animals is normally slightly alkaline. When Dr. Salant injected doses of the drug ergotamin into experimental animals whose blood alkalinity had been artificially reduced, a marked de-

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pression in their blood-pressure resulted. It was possible to restore the pressure to normal or even to increase it beyond that point, simply by controlling the degree of alkalinity of the blood.

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UNDULANT FEVER AND TULAREMIA

THE conquest of the world's latest threatening disease, undulant fever, is causing heavy casualties among the scientists who are engaged in the fight. While the disease is not often fatal, it is highly infectious and almost all the men and women who have been studying it have acquired it, in spite of every precaution. In this respect undulant fever is like tularemia, another comparatively new disease. These two are causing grave concern in public health circles because of their rapid and wide spread during the last few years. Tularemia, besides being very infectious, also results in death in many cases.

In this country four scientists of the U. S. Public Health Service have suffered from undulant fever, the latest one attacked being Dr. Edward Francis, who also acquired tularemia when he was investigating that disease. He had recovered, however, from tularemia before the attack of undulant fever. Of the others attacked by undulant fever, one, B. T. Stockrider, a laboratory technician, has entirely recovered. The other two, Miss Alice Evans and Dr. G. C. Lake, have recovered sufficiently to resume their work, but they have not yet regained health entirely, and are still subject to return attacks of the disease. It is these recurring attacks after periods of apparent recovery which give the disease its name of undulant fever.

Tularemia always attacked the laboratory workers during the first work done on it. All six of the men who studied it for the U. S. Public Health Service acquired it, some of them had it twice. The same thing has been observed in other countries. The Lister Institute of London recently asked the Public Health Service for cultures of the organism causing tularemia, so that their scientists could study the disease. When the cultures were sent, warning was also sent that it must be handled with extraordinary care. In spite of this, one of the workers at the institute acquired the disease. Knowledge gained in the study of the disease has now taught the investigators how to handle it safely.

Tularemia is usually acquired from rabbits who have the disease. Undulant fever may be acquired from infected goats, cows or other cattle or from their milk.

ITEMS

THE amount of influenza in the country is increasing, according to telegraphic reports received by the U. S. Public Health Service. The number of cases reported for the week ending November 24 is 8,433. For the preceding week 5,017 cases were reported. California and South Carolina still lead the country in number of cases. For the week just ended California reported 4,843 cases and South Carolina 1,770 cases. California had an increase of over a thousand cases in the last week. The other western states, including Montana, Utah, Oregon and New Mexico, all reported large numbers of influenza cases. The other communicable diseases are running their usual course for this season. Measles is especially prevalent in the middle Atlantic states, and is higher for the country as a whole this week. Smallpox is also higher. Vaccination, of course, is the means of preventing this disease.

THE passage of the Arkansas anti-evolution law will be the signal for a stiff fight by the American Association of University Professors for the right of their colleagues to teach science according to the laws of nature rather than according to the dictates of the anti-scientific forces of southern rural districts. This was indicated by Professor A. O. Lovejoy, of the Johns Hopkins University, prominent in the councils of the association, in an interview with *Science Service*. "We did not take part in the pre-election fight over this law," said Professor Lovejoy, "because we knew that the people in Arkansas would be sensitive and resentful about outside interference. But now that it is on the books it can be attacked—and we think successfully—on constitutional grounds. The American Association of University Professors will probably take action at an early date." The association has an active chapter at the State University comprising most of the faculty who are eligible to membership.

GREAT BRITAIN is planting new trees at the rate of 1,000,000 a week, according to information reaching the U. S. Department of Agriculture. Before the war the British Government estimated that there were about 3,000,000,000 feet of standing timber in the British Isles, while to-day it is estimated that the timber resources have been reduced to half that amount.

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SUBMARINE OBSERVATIONS OF SUB-OCEAN PRESSURES

PRESSURES along the bottom of the Atlantic Ocean force Porto Rico up and the ocean bottom north of it down to form the great Nares deep. This is indicated by observations of the intensity of gravity in this region made from the submarine *S–21*. Dr. F. A. Vening-Meinesz, of the Netherlands Geodetic Commission, who was in charge of the work, told about the investigation at a meeting of the Washington Academy of Sciences, the U. S. Navy Department and the Carnegie Institution of Washington. Dr. F. E. Wright, who, with E. B. Colline, of the Navy Department, accompanied Dr. Vening-Meinesz, spoke about the results and described some of the details of the trip. It lasted about two months and covered also the Gulf of Mexico and the Caribbean Sea.

Gravity measurements are made for two purposes, Dr. Vening-Meinesz explained. One is to ascertain the exact shape of the earth, while the other is to study the behavior of the crust of the earth.

The only way of measuring the intensity of gravity with the required accuracy is by timing the swings of a pendulum. A pair of scales would not show its variation because both sides of the scales would be affected equally. A pendulum, however, vibrates more rapidly the greater the gravitational pull. Previously, it has only been possible to make such gravity measurements on land, as the shaking of a ship interfered with the pendulum. Dr. Vening-Meinesz, however, invented a method of using two pendulums. While both are affected by the sway of the ship their motion may be combined in such a way that the result is the same as of one steady pendulum. As, however, the method can only be applied if the ship's motion does not exceed a certain limit, he made his observations from a submerged submarine, where the motion of the waves has very small effect. Two trips in a Dutch submarine from Holland to Java, in opposite directions, showed the practicability of the device. As a result of the cooperation of the U. S. Navy with the Carnegie Institution, he was extended the use of the American submarine *S–21* for gravity observations in the Gulf of Mexico and Caribbean Sea.

Submarine measurements have some advantages over land observations, he said. One is that there are no local irregularities of mass to cause disturbances, as there is nothing in the immediate vicinity of the submarine but water and air. Also, erosion, by which atmospheric conditions, such as wind and rain, rapidly shift land masses, is entirely absent on the ocean bottom.

In general, the investigations confirm the theory of isostasy, by which the earth's crust is supposed to consist of masses of various densities floating on a more or less fluid mass below. However, they found a departure of equilibrium in certain regions, which reveal stresses in the ocean bottom or in the subcrustal layers. One of these regions is the central part of the Gulf of Mexico. Besides that, two great ocean deeps were studied. One is the Bartlett deep, about 22,500 feet, southeast of Cuba and between that island and Jamaica. Here they had the busiest time of their trip, for in 18 hours they made 5 separate dives and observations. Altogether 49 gravity observations, each requiring a separate dive, were made. The Bartlett deep, however, rather unexpectedly showed no great stresses.

North of Porto Rico they studied the Nares deep, which showed great stresses at work. In the deep itself, the sides of which slope as much as 40 degrees in some cases, there was a deficiency of gravity, while to the south there was an excess. Dr. Vening-Meinesz thinks that this indicates that there is a horizontal pressure in a north and south direction in the ocean bottom in this region. This pressure causes a buckling, pushing Porto Rico up, and the deep down. The observations show that this pressure extends to even as far as East Cuba, *i.e.*, much farther than the configuration of the ocean floor indicates.

From their studies in the Gulf of Mexico, off the delta of the Mississippi, they found no evidence that the large masses which the river is continually depositing on the ocean bottom disturb the equilibrium. Apparently as fast as this deposit is laid down, the adjustments take place.

When the computation of the results is complete, some new light may also be shed on Wegener's theory that North and South America and Europe and Africa were originally joined, but that the western continent is floating away from the eastern. In his previous observations Dr. Vening-Meinesz found an excess of gravity off the Pacific shore of Central America, which might furnish an indication that the Americas were pushing westwards. This would be in accord with Wegener's ideas. Now during this expedition, observations were made off the Atlantic coast. If these prove that there is a deficiency of gravity in this region, it would be in accord with this theory, for it would show a pull, instead of a pressure, on the bottom. If it proves that gravity is in excess here also, however, the theory will get no confirmation.

Dr. Vening-Meinesz expressed his thanks to the U. S. Navy authorities and the Carnegie Institution for making this scientific investigation possible. He acknowledged the whole-hearted cooperation of Lieutenant Fisher in command of the *S–21*, of the commandant of the expedition, Lieutenant Nash, and of the officers and crew of the submarine.

MEASUREMENT OF THE HEAT OF THE STARS

How an infinitesimal electric current, which would have to be amplified twenty billion times to make it a single ampere, is used to study the temperatures of the stars and planets, was described on November 27 by Dr. Seth B. Nicholson at the Carnegie Institution of Washington.

NEW SCIENTIFIC BOOKS

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CHEMICAL REACTIONS AND THEIR EQUATIONS. Ingo W. D. Hackh. pp. x + 145.

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THE NATURE OF THE PHYSICAL WORLD. A. S. Eddington. pp. xvii + 361. $3.75.

This book contains the text of the author's Gifford lectures, delivered in 1927. Some of the subjects dealt with are: the downfall of classical physics; relativity; time; the running down of the universe; the quantum and the new quantum theory; world building.

The University of Chicago Press, Chicago

ELEMENTARY EUGENICS. Elliot R. Downing. pp. vii + 137. $1.75.

A revised edition of the author's earlier book, "The Third and Fourth Generation." It aims to present the underlying principles of the laws of heredity and eugenics in non-technical language for beginning students.

Methuen & Company, Limited, London

LETTERS FROM THE STEPPE. William Bateson. Edited by Beatrice Bateson. pp. xvi + 222.

Letters by Bateson, written in 1886-87 when he went on a natural history expedition to the West Central Asian Steppe, in which are set down his impressions of the countries through which he was traveling.

Frederick Warne & Company, Limited, London

THE SEAS. F. S. Russell and C. M. Yonge. pp. xiii + 379. Illustrated with color plates and photographs.

This book is designed for both lay-readers and university students. It discusses the sea bottom, coral reefs, color and phosphorescence, swimming animals, feeding of marine animals, sea water, methods of oceanographical research, sea fisheries and related subjects.

Stanford University Press, Stanford University, California

NATURAL CONDUCT. Edwin B. Copeland. pp. vii + 262. $3.50.

The ethical code of the scientist—a code based on the modern teachings of biology—is here presented as a foundation for a modern social structure. Many of the old, familiar ideals, codes and virtues are affirmed by this new system.

D. Appleton and Company, New York

THE PSYCHOLOGY OF THE ADOLESCENT. Leta S. Hollingsworth. pp. xiii + 259.

A formulation of the universal problems of the adolescent as they appear at present, under conditions of contemporary life. One purpose of the book is to assist parents and teachers in understanding the adolescent mind.

John Wiley & Sons, Incorporated, New York

HERMIOTHERMISM. A. S. Pearse and F. G. Hall. pp. ix + 119. $2.00.

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Dr. Nicholson is an astronomer at the institution's Mt. Wilson Observatory. One of his discoveries, made in 1914, while at the Lick Observatory, was a previously unknown moon of the planet Jupiter.

"The greatest success in measuring the heat received from the stars has been obtained with the thermocouple," he said. "A thermocouple consists of a junction of two elements which, when heated, generates an electric current, that can be measured with a galvanometer, which is an extremely sensitive ammeter. The weight of a complete thermocouple with receivers one half millimeter in diameter, including the connecting wires, is about one thousandth that of a drop of water. The mass of the receiver which is heated by the star is only one third that of a complete thermocouple.

"A star, of the same color as the sun, which is just bright enough to be easily seen without a telescope, radiates on the whole United States about the same amount of heat as is radiated by the sun on one square yard. When the heat from such a star which falls on the 100-inch mirror of the Hooker telescope at Mt. Wilson, the area of which is six square yards, is focused on the receiver of a thermocouple, the temperature of the receiver is increased about one half millionth of a degree Fahrenheit, and a current of electricity is made to flow through the galvanometer. The current thus generated is about one twenty billionth of an ampere. The currents produced in this way are proportional to the amount of heat received by the thermocouple, so that the deflection of the galvanometer when a star is focused on the thermocouple is a measure of the heat received from the star.

"The heat from many stars has been measured in this way, and of those measured more heat reaches the thermocouple from the red star Betelgeuse, in the constellation of Orion, than from any other. Much of the heat from stars and from the sun is absorbed by the earth's atmosphere. This absorption is especially large in the blue and violet light and when allowance is made for this loss we find that more heat reaches the earth from the blue star Sirius than from any other star."

Though the planets shine with reflected sunlight and are far cooler than the stars, the thermocouple can be used to measure their temperature, he said, in telling of results.

"Mercury is certainly very hot and has little if any atmosphere. The maximum temperature is about 1,300 degrees Fahrenheit. The distribution of radiation over its surface is much like that of the moon. Venus is covered with clouds and the radiation measured is from the high cloud surfaces and tells very little except by inference about the actual surface temperature. The night temperature on Venus is much higher than that on Mercury or the moon, being about 9 degrees below zero Fahrenheit. The temperature on Mars varies greatly with the season and the time of day, but the temperatures there are somewhat like those on the earth, at least like those at very high elevations where the atmosphere is rare. The outer planets are very cold, as might be suspected from their great distances from the sun, unless they give off heat from their interiors. Not many years ago it was commonly supposed that Jupiter was warm, probably warm enough to give out some light of its own. The thermocouple measures show that this is not the case, and that the temperature of Jupiter is about 216 degrees below zero Fahrenheit."

THE RISING OF SAP IN TREES

SAP does not rise in trees, it gets pulled up. There are no hearts or other pumps, and the mysterious "root pressure" that used to be talked about is little more than a myth. And water, though "as weak as water" in large masses, is as strong as wire when confined within the walls of the tiny tubes that make up the sap-wood of trees.

These are elements in the picture of the inside of a plant's water-distributing system, worked out by Dr. D. T. MacDougal, of the Desert Laboratory, Tucson, Ariz., who lectured before the Carnegie Institution of Washington on December 12. One of Dr. MacDougal's most recent discoveries is that the air confined in the dead vessels of a tree trunk forms a single connected system, just as the sap does. By applying pressure instruments to different parts of the tree's anatomy, he discovered that changes of pressure in one part of the confined air were rapidly transmitted to all parts of the tree.

The paradox of water having a tensile strength, and holding up a weight as though it were made of wire, is the problem that has engaged Dr. MacDougal's major attention for several years. Pioneer work in the same field was done by a British plant physiologist, Dr. H. H. Dixon, and other workers on the continent. These experiments have shown that as water evaporates from the surface of the leaves it creates a condition of tension in the interior. This tension is transmitted through the leaf-stem and branches to the trunk and down to the roots that draw upon the water supply in the soil.

INSECT ECOLOGY

THE more "modern" insects, the species most recently evolved, have a higher metabolic rate, faster physiological processes, move more rapidly, and prefer bright sunlight and the warmer parts of the earth.

This is the thesis advanced by Dr. Clarence H. Kennedy, of Ohio State University, writing in the current issue of the scientific journal *Ecology*. He has made a special study of the dragon-flies, but has examined also the family trees and present modes of living of a large number of other groups of insects, and in general he finds that they all fall into line with his theory.

"Modern" or recently evolved insects in general have three preferences. They like the tropics as a place to live, they prefer open, sunny places rather than dim woods or shelters under bark or stones, and when they needs must live in a cooler zone they thrive best in the hot summer rather than in the cool spring. Insects of this group include such active and relatively intelligent orders as the ants and bees, the higher dragon-flies and the day-flying butterflies.

The tastes of the old-fashioned insects, which have sometimes been called "surviving fossils," are just the

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The Biological Bulletin (M. B. L., Woods Hole, Mass.)
Folia Anatomica Japonica (Tokio, Japan)
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Another point developed by Dr. Kennedy has to do with the length of life of the groups compared. The "slow" insects live long—breed only once a year as a rule, or sometimes require several years to come to maturity. He cites one primitive genus, an intermediate form between crickets and cockroaches, which takes three years to come to maturity, and which has to be raised on ice in a refrigerator. The "fast" moderns, on the other hand, mature and reproduce much more rapidly, a couple of weeks sufficing for the whole life cycle of some of the higher flies. Theirs seems to be a short life and a merry one.

FEDERAL APPROPRIATIONS FOR THE STUDY OF CANCER

PROMISING results for further work looking towards the solution of the public health problem of cancer have been obtained in experiments with high-frequency electrical currents, Dr. Hugh S. Cumming, U. S. Surgeon-General, told the House Appropriations Committee, according to the hearings on the Treasury Appropriation bill.

The work with high-frequency currents has been carried on by the Public Health Service both at Harvard University and at the public health laboratories at Washington. Dr. Cumming testified that an appropriation of $75,000 had been asked of the Budget Bureau for research work into the causes and nature of the malignant growths known as cancer, but that this amount had not been allowed. The item in the bill now before the House is $15,760 for cancer work by the Public Health Service for the fiscal year ending June 30, 1930.

"During the studies at Harvard," Dr. Cumming said, "it was found that high-frequency electrical currents would injure the tissue and that it seemed to bear a relation to the frequency of the currents. Without going into it in greater detail Dr. Scherechewsky, who is in charge of that work, has apparently cured a great many cases of tumor in the animals he has worked on. I have seen some of the work myself. He has not felt that the time has yet come when he could try it on human beings, but I am persuaded that he could get a great many volunteers.

"Experimental work was begun with a transplantable mouse sarcoma of high virulence," he continued. "In a considerable number of instances tumors exposed in this way recede and disappear, with the eventual recovery of the tumor-bearing animal, while in control animals the tumor grew progressively, causing the death of the animal in from four to six weeks.

"The action of these currents appears to be different from the action of ordinary high-frequency currents applied by means of conventional therapeutic high-frequency apparatus, as under suitable conditions the healing effect upon the tissue is slight. Nevertheless a few minutes' exposure—from 3 to 3½ minutes—of the tumor tissue to a current of 250 to 300 milliamperes at a frequency of 66,000,000 to 68,000,000 cycles per second is sufficient to produce in many instances complete insarction of the tumor and destruction of the tumor cells with subsequent disappearance of the tumor."

ITEMS

A SUBCOMMITTEE of the Radio Manufacturers' Association's committee on engineering, with Dr. D. E. Replogle as chairman, recently met in Chicago with representatives of the leading manufacturers, and others interested in radiovision, including C. Francis Jenkins, of Washington. Although there are still only a few radiovision broadcasters, compared with the sound broadcasters, they have been employing a variety of methods. The committee adopted as standard the system used by C. Francis Jenkins in broadcasting movies from his station in Washington. This makes use of 48 lines in the scanning disc, arranged so that the lines follow each other from top to bottom, and left to right consecutively, like lines of type on a printed page. The committee also adopted the use of the word "frame" as referring to a single picture area. It is expected that all the television broadcasters will now adopt these standards, so that one radiovision receiver with one scanning disc will be able to receive any of them.

WISE men of Egypt knew Euclid's mathematical methods fifteen centuries before the famous Greek organized the subject and set his material down in such perfect form that college boys still study "Euclid." Proof is available through the translation of the "Mathematical Papyrus" which lies in the collection at the Hermitage Museum, and has long challenged the best efforts of Egyptologists. A report from Leningrad states that this papyrus has finally been deciphered. It dates back to the eighteenth century before Christ, and contains twenty-five problems on geometry and algebra. "Mathematical methods applied in the papyrus are almost 1,500 years ahead of Euclid, corresponding entirely to the present time."

EYE stress is a great thief of nervous energy and is responsible for many cases of insomnia, disturbances of circulation and gastrointestinal tract, according to a report by Dr. E. L. Jones in *International Clinics*. Because of the extremely close relation between the nerves that govern the focusing muscle of the eyes and those nerves that govern the heart and organs of the intestinal tract, many symptoms of distress and actual disease of heart and intestinal tract may be largely due to eye stress. Eye stress, according to Dr. Jones, is "the overcoming, by unconscious effort, of an impediment in the focus of the eye, to obtain its best vision." It has no relation to neat or fine work and is most common in persons having nearly perfect or perfect vision, either with or without glasses.

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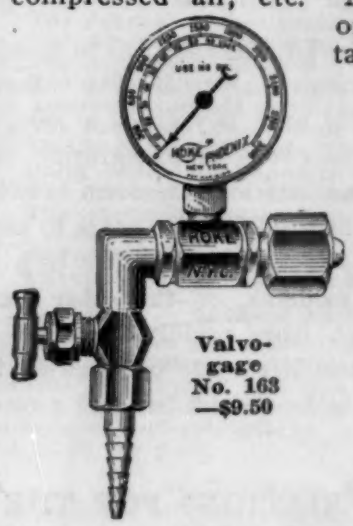

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SCIENCE NEWS

Science Service, Washington, D. C.

SCIENCE IN 1928

PHYSICS

THE cosmic rays which bombard the earth from outer space are evidence of the continuous creation of common elements out of electrons there, Dr. R. A. Millikan and Dr. G. Harvey Cameron, of the California Institute of Technology, announced.

The Michelson-Morley experiment was repeated by Professor A. A. Michelson, at Mount Wilson Observatory, with much improved apparatus, and he announced that no motion of the earth through the ether of space could be detected.

Experiments with a thin film of gold conducted by Professor George P. Thomson, of the University of Aberdeen, demonstrated that a stream of electrons contains waves, which may be the electrons themselves or may accompany the real electrons.

Ultra-violet rays in sunlight are responsible for the ionization of the upper layer of the earth's atmosphere which is connected with the Kennelly-Heaviside layer that reflects radio waves downwards, thus making long-distance radio communication possible, announced Dr. E. O. Hulburt, of the U. S. Naval Research Laboratory.

The hypothetical element, "coronium," visible in the sun's corona during eclipses, may be identical with the rare gas argon, indicated by experiments of Dr. Ira M. Freeman, of the University of Chicago.

The highest electrical potential ever achieved by man, more than 5,000,000 volts, was obtained by Dr. Gregory Breit and Dr. M. A. Tuve at the Department of Terrestrial Magnetism of the Carnegie Institution of Washington.

X-rays produced at the California Institute of Technology, with an electrical force of a million volts, by Drs. S. C. Lauritsen and R. D. Bennett, showed the way towards artificial production of cosmic rays.

"Artificial lightning," at a potential of 3,600,000 volts, was generated at the Pittsfield laboratory of the General Electric Company.

Super-sonic waves, which are sounds vibrating too rapidly to be audible, were brought under such control that their action could be studied under a high-power microscope by Professor E. Newton Harvey, of Princeton, and Alfred L. Loomis, of Tuxedo, N. Y.

Inaudible sound waves, nicknamed the "death whisper" because they kill small organisms in water, were produced at the unprecedented rate of two and one half million per second in the private laboratory of Alfred L. Loomis at Tuxedo Park, N. Y.

Sheets of iron, gold and other metals so thin as to be transparent, were prepared by Dr. Carl Mueller, of Charlottenburg, Germany.

Penetrating radium rays were used to test metal castings for flaws at the Russian State Radium Institute, Leningrad.

That helium gas leaks slowly through glass, even through high-quality pyrex, was demonstrated by experiments conducted by three Harvard scientists.

The use of exploding gas in rockets as a propulsive force for automobiles was successfully demonstrated in Germany by Fritz Opel.

The first actual measurements of the speed of lightning showing that it takes about one seven thousandth of a second to complete itself and that it starts from the cloud and the ground at nearly the same instant, the two ends uniting in mid-air approximately one seven thousandth of a second later, were determined by Professor C. V. Boys, the British physicist.

Outdoor television was pronounced possible through use of an extra large lens, with an extra large scanning disc, and extra large holes, all of which results in more light being picked up and focused on the surface of the sensitive cell, in a report to the Optical Society of America, by Dr. Frank Gray and Dr. Herbert Ives.

The development of talking motion pictures was continued and several photo-dramas with complete dialogue and no printed titles were produced.

A million-volt cathode ray tube, equivalent in radiating power to a ton of radium, was built by Dr. W. D. Coolidge, of the General Electric Company.

An improved cathode ray tube, simpler than an X-ray tube, was perfected by Dr. C. M. Slack, of the Research Department of the Westinghouse Lamp Company, making it possible for any well-equipped research laboratory to have at its disposal the important cathode rays.

A high-power short-wave vacuum-tube able to light electric lamps without touching them was demonstrated in the laboratories of the General Electric Company, Schenectady, N. Y.; it heats flesh and blood in its vicinity, and can cause an artificial fever of 100 degrees Fahrenheit.

Two Swiss physicists, Dr. A. Piccard and Dr. E. Stahel, performed an ether-drift experiment with negative results.

A new X-ray moving picture camera which can be set to take pictures at regular intervals was invented by Arthur C. Pilsbury, of Berkeley, California, and believed to have important possibilities in showing inner processes, such as the knitting of broken bones.

A red neon arc light, claimed to be capable of shining through fog, and intended for airport beacon use, was invented by Dr. Clifton G. Found, of the General Electric Company, in collaboration with J. D. Forney, of the Cooper-Hewitt Electric Company.

A magnetic method of detecting flaws in steel castings as large as five or six inches thick was reported by Alfred V. de Forest, of Bridgeport, Conn.

A new metal so hard that it bores smooth holes in concrete, or cuts screw threads in a glass rod, was produced from a compound of tungsten and carbon and cobalt by Dr. Samuel L. Hoyt, of the research laboratory of

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ECOLOGY

By FREDERIC E. CLEMENTS
and Collaborators

No. 242. Clements, Frederic E. Plant Succession: An Analysis of the Development of Vegetation. Published 1916.

No. 290. Clements, Frederic E. Plant Indicators: The Relation of Plant Communities to Processes and Practice. Published 1920.

Both of the above books are out of print. However, Dr. Clements has succeeded in combining the greater part of both into a new volume entitled:

Plant Succession and Indicators. A Definitive Edition of Plant Succession and Plant Indicators. Octavo, xvi + 453 pp., 44 pls., 24 figs. (1928).

This new volume contains all of the chapters of the first that deal with the principles and methods employed in the study of climaxes and succession in present-day vegetation, and all the chapters of the second except the one concerned with the climax formations of North America. This volume is not for sale by the Institution, but copies may be purchased from H. W. Wilson Co., 958 University Avenue, New York City, at the price of $8.50.

Other volumes by Dr. Clements and his collaborators, for sale by the Institution, are:

No. 315. Clements, Frederic E. Aeration and Air-Content: The Rôle of Oxygen in Root Activity. Octavo, 183 pp. $2.00

No. 355. Clements, Frederic E., and John E. Weaver. Experimental Vegetation: The Relation of Climaxes to Climates. Octavo, vii + 172 pp., 15 pls., 41 figs. $2.50

No. 356. Clements, Frederic E., and G. W. Goldsmith. The Phytometer Method in Ecology: The Plant and Community as Instruments. Octavo, 112 pp., 11 pls., 45 figs. $1.75

No. 326. Hall, H. M., and Frederic E. Clements. The Phylogenetic Method in Taxonomy. A Monograph of the North American Species of Artemisia, Chrysothamnus, and Atriplex. Quarto, iv + 355 pp., 58 pls., 47 figs. $6.75

No. 389. Douglass, A. E. Climatic Cycles and Tree-Growth: A Study of the Annual Rings of Trees in Relation to Climatic and Solar Activity. Octavo. Vol. 1 is out of print. Vol. 2 ..... $2.75

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A new camera, which makes photographs that appear solid to the eyes and which shows different sides of the object depending on the angle from which the picture is viewed, was exhibited to scientists by its designer, Dr. Herbert E. Ives, the inventor of the method being Dr. C. W. Kanolt.

A triple film which would enable the amateur to make color snapshots with ordinary light and an ordinary camera was announced by F. J. Tritton, a British scientist.

Natural color movies that every one can make and project were developed by the Eastman Kodak Company under the direction of Dr. C. E. K. Mees.

The Congressional Gold Medal was conferred on Thomas A. Edison by action of Congress and presented by Secretary of the Treasury Mellon at the Edison Laboratories, October 20.

The Optical Society of America celebrated the fiftieth anniversary of Professor Albert A. Michelson's first announcement of his determination of the velocity of light by naming its annual meeting the Michelson Meeting.

A medal to be awarded annually by the Optical Society of America, for outstanding work in optical science was founded by Dr. Herbert E. Ives, of the Bell Telephone Laboratories, in honor of his father, Frederic E. Ives, inventor of the half-tone process and other photographic methods.

Chemistry

Gluconic acid, a chemical hitherto obtainable only at a price of $100 a pound, was produced at 35 cents a pound by chemists at the Color Laboratory of the U. S. Department of Agriculture, using a species of mould growing on a glucose solution.

Edible fats and fatty acids for soap-making were made from paraffin through catalytic methods developed by the chemists of the German Dye Trust.

A magnetic theory of catalytic action in which molecules and atoms are conceived as having two poles like a bar magnet was advanced by Dr. Karl Krauch, German chemist.

Wall-board is being manufactured from corn-stalks in a special semi-commercial plant set up at Ames, Iowa, by the U. S. Bureau of Standards in cooperation with Iowa State College.

A commercial plant for making paper out of corn-stalks was built in Illinois, the first of its kind.

The process for converting wood waste into an edible carbohydrate suitable for hog food devised by Dr. Friedrich Bergius, German chemist, was improved to the point of semi-commercial production.

The U. S. Bureau of Chemistry and Soils has evolved two methods of making from corn-cobs insulating briquettes to be used as a substitute for cork, especially in small refrigerating units.

A successful substitute fabric has been developed to replace goldbeater's skin in the making of gas cells for airships, and several months' use in the *Los Angeles* shows the new material to be cheaper and fully as good.

Anthraquinone, a basic raw material in the manufacture of dyes, was made by cheaper methods involving the use of catalysts or solution in furfural as a result of research by Dr. A. O. Jaeger, of Pittsburgh.

New methods of making artificial rubber were announced in Germany, though the process was not divulged.

A new explosive, known as "radium atomite" and claimed to be superior to T. N. T. or dynamite, was demonstrated to army engineers by Captain H. R. Zimmer, of Los Angeles.

Synthetic sugar, from fructose and glucose, was made by two Swiss chemists, Professor Ame Pictet and Hans Vogel.

"Bios," a vitamin that promotes the growth of yeast, was obtained in pure crystalline form by Dr. W. Lash Miller, of the University of Toronto.

Experiments by dairy experts of the U. S. Department of Agriculture demonstrated that milk exposed to sunlight develops undesirable flavors and odors, whereas milk kept in the dark does not.

"Sunshine pills," consisting of synthetic Vitamin D, made by exposing ergosterol from yeast to ultra-violet rays, were placed on sale in Germany and England as a substitute for cod-liver oil.

An ultra-violet irradiated food was placed on the market, a commercial application of the discovery that ordinary foods exposed to ultra-violet rays promote the formation of healthy bones and teeth in children and young animals.

A new way to preserve ether for as long as eight months, without spoiling or deterioration, was devised by S. Palkin and H. R. Watkins.

A new system of chemical shorthand was developed by Louis A. Leslie, of New York, and Dr. C. A. Jacobson, professor of chemistry at West Virginia University.

The 1928 Nobel prize for chemistry was awarded to Dr. Adolf Windaus, of Göttingen, Germany, for his part in experiments proving that ultra-violet light, either in sunlight or artificially produced, will activate ergosterol and confer on it antirachitic properties.

The Nobel prize award for chemistry, 1927, went to Professor Heinrich Wieland, of Munich, Germany, in recognition of experiments on the complex compounds known as the bile acids.

A gearless auto that changes speed automatically was described to the Society of Automotive Engineers by a French engineer, D. Sensaud de Lavaud.

An instrument defined as a "breathing device," which experts believe will save the lives of men submerged in sunken submarines, has been devised by Lieutenant C. B. Momsen, Chief Gunner C. L. Tibbals, both diving experts, and F. M. Hobson, engineer in the Naval Bureau of Construction and Repairs.

Pulverized coal was applied to the propulsion of seagoing vessels, the initial installation being the U. S. Shipping Board vessel, *S. S. Mercer*.

Radio equipment for communication between the front and rear ends of long freight trains has been installed by the Baltimore and Ohio Railroad for demonstration on that system.

Princeton University Press, Princeton

THE FUEL OF LIFE. John J. R. Macleod. pp. ix + 147. $2.50.

This volume, by the codiscoverer of insulin, reviews evidence of importance favoring the view that carbohydrate can be produced from fatty acids in animals, as it is in plants. An attempt has been made to present the subject as simply as possible.

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TAKING THE DOCTOR'S PULSE. J. F. Montague. 103 pp. $1.00.

Constructive criticism of the present-day practice of medicine in an effort to influence future practice along lines which the author believes will be of benefit to humanity.

Houghton Mifflin Company, Boston

INTELLIGENCE TESTS. Walter F. Dearborn. pp. ix + 336.

The author examines present-day intelligence tests, together with the various misconceptions that have arisen regarding them. He points out their value and shows how in many respects they are in need of revision. He lays stress on the part which learning plays in determining intelligence.

American Photographic Publishing Company, Boston

THE AMERICAN ANNUAL OF PHOTOGRAPHY, 1929. Edited by: Frank R. Fraprie and E. J. Wall. pp. 67 + 240. Illustrated.

This book will doubtless prove of value to the many scientific men who find photography a useful tool in connection with their work in the fields of astronomy, medicine, exploration, engineering and nature study. The book treats of various photographic processes and has 208 illustrations.

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Injections of glucose were found to be beneficial in acute cases of encephalitis, the European sleeping sickness.

A new theory that cancer is associated with and possibly controlled by the relative alkalinity of the blood was advanced by Dr. Ellice McDonald, chairman of cancer research of the University of Pennsylvania.

A lack of the important beta hormone, which controls the water depots of the body and the ability of the tissues to use water and which is in the post pituitary gland at the base of the brain, may be made up by an artificial supply from animal glands, according to Dr. Oliver Kamm, of Detroit, Michigan.

Operation of apparatus transmitting short radio waves was found to produce fever in bystanders, and Dr. Helen R. Hosmer, of Albany Medical College, began experiments with the electrically induced fever on animals, since fever is now an important treatment of progressive paralysis.

The effect of a dose of medicine depends not merely on the chemical makeup of the medicine but also on the alkalinity of the blood and on the particular balance of certain blood elements, experiments by Dr. William Salant, of the University of Georgia Medical School, indicated.

A new water purifier, succinchlorimide, that will not deteriorate with age was announced by its discoverer, Major C. B. Wood, of the U. S. Army Medical School.

That a new industrial hazard, chromium poisoning, is definitely increasing as a result of the widespread use of chrome plating on automobile accessories, was reported to the American Medical Association by Dr. Jackson Blair, of Cleveland, and studied by the U. S. Public Health Service.

That paper mulberry is one of the plants responsible for "hay fever" is reported by Dr. Henry S. Bernton, of Washington.

Nobel Prize in medicine for 1928 was awarded to Professor Charles Nicolle, of the Pasteur Institute at Tunis, in recognition of his typhus fever researches which have shown how the disease may be prevented.

The Grand Cross of the French Legion of Honor was awarded to Dr. Albert Calmette, of the Pasteur Institute, for his work in producing a tuberculosis vaccine.

Aeronautics

The voyage of the *Graf Zeppelin*, with passengers and mail, from Friedrichshafen, Germany, to Lakehurst, N. J., established the practical value of transatlantic ransportation lines.

The airplane *Southern Cross*, piloted by Captain arles Kingsford-Smith and Captain C. T. P. Ulm, with utenant-Commander Harry W. Lyon as navigator and s Warner as radio operator, flew from Oakland, to Sydney, Australia, a total distance of 7,800 n approximately 88½ hours' flying time.

ascontinental non-stop flight was made in 18 a trip 58 minutes.

record t D. Collyer and John Henry Mears completed the world by airplane and steamer in the 23 days, 15 hours and 8 seconds.

Captain Arturo Ferrarin and Major Carlo del Prete, flying a Savoia-Marchetti S–64, established a world's airline distance record of 4,466 miles in a flight from Rome to Brazil.

Captain Dieudonne Costes and Lieutenant-Commander Joseph le Brix, French aviators, completed on April 14, 1928, a 35,000-mile trip around the world begun October 14, 1927, flying their Breguet XIX biplane the entire distance except for the trip across the Pacific Ocean.

Captain Arturo Ferrarin and Major Carlo del Prete gained the world's closed circuit distance record of 4,763.7 miles.

Johann Risztics and Wilhelm Zimmerman, flying a Junkers W–33, established a world's duration record of 65 hours and 25 minutes.

Adjutant Louis Crooy and Sergeant Victor Gronen, flying a DH–9, established a world's duration record of 60 hours and 7 minutes, refueling in flight and returning to point of departure.

Eddie Stinson and George Haldeman, flying a Stinson-Detroiter, established a world's endurance record of 53 hours, 36 minutes, and 30 seconds.

Major Arturo Ferrarin and Major Carlo del Prete, flying a Savoia-Marchetti plane, established a world's duration record of 58½ hours.

Harry J. Brooks, flying a Ford monoplane, established a world's airline distance record of 972 miles for light airplanes weighing 440–771 pounds.

M. Maurice Finat, flying a Caudron C 109, established a duration record of 24 hours and 36 minutes for light airplanes.

Major de Bernardi, flying a Macchi 52 seaplane, established a world's speed record of 318.62 m.p.h.

Peter Hesselbach remained aloft in his glider, *Darmstadt*, for 4 hours and 5 minutes, thus establishing an American glider record.

Juan de la Cierva flew his autogiro from London to Paris.

The rigid airship, *U. S. S. Los Angeles*, was successfully landed on the deck of the airplane carrier *U. S. S. Saratoga*.

The airship *Italia*, under the command of General Umberto Nobile, was wrecked after successfully crossing the North Pole; Lieutenant Lundborg, of Sweden, rescued General Nobile from the ice floe where members of the *Italia* crew were stranded.

Roald Amundsen, Arctic explorer, who set out in search of survivors of the wrecked airship *Italia*, was lost.

Eventual propulsion of aircraft by motors operating on heavy oil fuel and self-igniting on the Diesel principle was forecast by experiment with new type engines by the Junkers aircraft concern.

A "foolproof" airplane, designed by Albert A. Merrill, of the California Institute of Technology, and constructed by him in association with Dr. A. L. Klein and Dr. Clark Millikan, was demonstrated in Los Angeles.

A new radio altitude meter for airplanes was developed by Dr. E. F. W. Alexanderson, of the General Electric Co.

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Lehrbuch der Optik. KARL FÖRSTERLING. 610 pp. 193 illustrations. $9.60.

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Lichtelektrische Erscheinungen. BERNHARD GUDDEN. 325 pp. 127 illustrations. **(Struktur d. Materie in Einzeldarstellung.** VIII.) $6.05.

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Vier Vorlesungen über Wellenmechanik, geh. an d. Royal Institution in London im März 1928. EDWIN SCHRÖDINGER. 57 pp. 3 illustrations. Paper bound. $1.00.

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Handbuch für Flugzeugführer. Edited by HANS GEORG BADER. 193 pp. 91 illustrations. 7 tables. $2.88.

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GRAND CENTRAL TERMINAL, NEW YORK, N. Y.

A case of a mare mule which not only bore two healthy colts but had a grandchild was reported by A. H. Groth, of the Agricultural and Mechanical College of Texas.

Canada undertook a census of the animals remaining in her musk-ox herds.

The attempt of the Soviet Government to save from extinction the wisent, Europe's representative of the bison family, failed, since careful searches of the 1,100 square mile reserve made by naturalists showed no trace of a single living animal.

That the first milk a cow produces after giving birth to her calf should be fed to the calf because it contains substances that ward off diseases was reported by Dr. Theobald Smith.

The Carnegie Institution of Washington has completed a eugenical study concluding that laws for deportation of public charges becoming such from hereditary defectiveness should be extended and enforced.

Tuberculosis in livestock has declined, due to the cooperation of the Bureau of Animal Industry with local authorities; 11,300,000 cattle were tested during the past year.

The work of eradicating cattle ticks from southern states gradually reclaimed more territory from the pest.

A hybrid of the radish and cabbage was produced by Dr. George D. Karpenchenko, of the Botanical Institute at Detskoje Selo, in Russia.

Each species of tree has a definite pattern according to which sap and gases within its trunk are localized, and the gas body within each tree is continuous, studies by Dr. D. T. MacDougal, of the Desert Laboratory, Tucson, Arizona, disclosed.

Zinc and boron are needed by plants, Miss A. L. Sommer and Professor C. B. Lipman found at the University of California.

The fig growers of California cooperated with state officers in a strong effort to clean up the destructive brown-rot disease.

Two varieties of cattle grubs caused damage to livestock raisers estimated as $100,000 for the past year.

Borax, in a concentration of one and one half parts to a thousand of water, was discovered by Professor Robert Matheson and E. H. Hinman, of Cornell University, to be a fatal poison for mosquito larvae or wigglers.

Experiments with enormous cages, constructed of copper wire screening under the supervision of Dr. W. H. Larrimer on a farm maintained by the U. S. Bureau of Entomology near Toledo, Ohio, indicated that while it will be impossible to eradicate the corn borer, it can be controlled sufficiently to reduce commercial losses to a negligible amount.

A comparatively new bacterial disease known as "halo spot" destroyed large acreages of beans in the regions of Montano, Wyoming and Colorado.

The $1,000 annual prize of the American Association for the Advancement of Science, for outstanding research during the preceding year, was awarded to Professor H. J. Muller, of the University of Texas, for his work on producing new varieties of fruit flies by X-ray treatment.

Scientists the world over celebrated the eightieth birthday of Hugo de Vries, foremost student of evolution since Darwin's time.

Medicine

A new minimum death rate for tuberculosis in 1928 is reported by the Metropolitan Life Insurance Company. The new rate is 72.1 per 100,000.

Yeast exposed to ultra-violet rays, either from sunlight or an artificial source, has its fertility vitamin E destroyed, Dr. B. M. Strong, of the school of medicine at Loyola University, Chicago, found.

Vitamin D, which prevents rickets in young animals, may also play an important part in the development of the egg, Dr. Alfred F. Hess, of New York, announced.

The presence of copper in the diet is a preventive of anemia, Dr. E. B. Hart, of the University of Michigan, found.

Teeth, shining by fluorescent light in the dark under the influence of ultra-violet rays, reveal by dark spots the regions where decay will develop, Dr. H. C. Benedict, of the Northwestern University School of dentistry, found.

An instrument for measuring a person's sensitivity to sunburn was invented by Dr. Robert C. Burt, of Pasadena, Calif.

Dr. Hideyo Noguchi, of the Rockefeller Institute, died of yellow fever as a martyr to his researches on that disease, leaving research which may show that the disease has two forms.

Eleven lepers were released, by the U. S. Public Health Service, apparently cured and no longer a menace to the community, from the National Leper Home at Carville, La.

Means were found for administering chaulmoogra oil, the remedy for leprosy, without the pain and nausea which patients have had to endure in the past.

Epilepsy was produced artificially in dogs by a brain operation by Dr. Lawrence O. Morgan, of the University of Illinois.

A method of investigating the brain by means of X-ray photographs was perfected by Dr. Max Ludin, director of the Röntgen Institute of the Citizens' Hospital of Basel, Switzerland.

High-frequency electric currents were found to be beneficial in checking cancerous growths of mice and chickens.

For his work on tularemia, or rabbit fever, Dr. Edward Francis, of the U. S. Public Health Service, was awarded the gold medal of the American Medical Association, the committee on awards declaring that his contributions to the knowledge of the disease were the most important medical work of the year, judged on the basis of originality.

The final step in scientific conquest of Oroya fever, which afflicted the Incas and still occurs in Peru, was announced by four scientists of the Rockefeller Institute, who proved that the disease is spread by gnats.

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SCIENCE NEWS

Science Service, Washington, D. C.

SCIENCE IN 1928

Geology and Geography

II

A blow to theories of land in the Arctic was dealt by the flight of Wilkins and Eieleson over the unknown Polar region during which no land was sighted.

Four ships carried the Byrd Antarctic expedition far south to the Bay of Whales, from which base attempts will be made by aeroplane to explore the Antarctic region.

Polar explorations in the dirigible *Graf Zeppelin*, which successfully made a round trip from Germany to the United States, were announced by a German organization known as *Aeroarctic*.

An expedition to study the birthplace of the icebergs, between Greenland and Baffin Land, was sent out by the U. S. Coast Guard on the *U. S. S. Marion*, under command of Lieutenant Commander Edward H. Smith.

The non-magnetic yacht *Carnegie*, of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, set out on a three-year cruise to all parts of the world to make new observations of electrical and magnetic conditions as well as other scientific researches, under the command of Captain J. P. Ault.

A new volcano was discovered in eastern Ecuador by Joseph H. Sinclair, leader of an expedition sent out by the American Geographical Society.

The Mayon volcano, after being quiet for 28 years, became active and destroyed Libog and several neighboring villages in the Philippines.

Vast fields of pumice and volcanic ash, floating on the surface of the South Pacific Ocean between the Fiji and Tonga groups of islands, revealed the existence of a new submarine volcano.

Falcon Island, in the South Pacific, famed for its sudden disappearances, showed its head above the waves again.

A wheeled boat, able to travel on land and water, was used in an exploration of the volcanic islands of Alaska by Dr. T. A. Jaggar, of the Hawaiian Volcano Observatory.

Roy Chapman Andrews returned to America at the close of the 1928 season of the Central Asiatic Expedition, bringing much fossil material with him.

The discovery by two high-school boys of Fillmore, Utah, of an unfossilized skull of an extinct camel, found in a lava cave some twenty miles southwest of their home, revolutionizes our ideas of the course of events in recent geological time, according to Professor Alfred S. Romer, of the University of Chicago, who examined the skull.

The greatest geyser now active in the world and the greatest of all history, except the old Excelsior Geyser which has been extinct since 1888, became active in Yellowstone National Park.

New knowledge of the origin and history of the Grand Canyon of the Yellowstone was obtained as a result of the geological research of the Princeton Summer School of Geology and Natural Resources.

A new national park, Bryce Canyon, was established on September 15.

New fossil footprints were found on the north rim of the Grand Canyon of Arizona.

Fossil seaweed found in the rocks along the Penobscot River demonstrated that the ancient Cambrian Sea once flowed over the region of Maine.

Plans were laid for the first international census of agriculture, to be taken in 1929 and 1930.

More than 1,000 square miles of Alaskan wilderness were surveyed by the new airplane-packhorse method by the U. S. Geological Survey.

Twenty-one earthquakes, of unusually severe character, in the various parts of the world, were located by experts of the U. S. Coast and Geodetic Survey, in cooperation with Science Service, within a few hours after they occurred, in many cases anticipating by several days actual reports from the damaged area.

A new electrical seismograph, for recording distant earthquakes, was invented by Dr. Frank Wenner, of the U. S. Bureau of Standards, and was proved satisfactory in numerous tests.

Severe landslides occurred at Santos, in southern Brazil, early in March.

Biology

A moving picture record of the living rabbit's egg which discloses many new phenomena hitherto unknown was obtained by Dr. W. H. Lewis and Dr. P. W. Gregory.

The parathyroid gland plays a large part in the control of sex of unborn offspring, according to Dr. Simon B. Chandler, of the Loyola University School of Medicine, Chicago.

A new vitamin, needed by young trout for normal growth, was discovered in raw liver by a group of biologists at Cornell University, and received the provisional name "Factor H."

Legs and hearts were transplanted from axolotls to tritons, animals related to frogs and toads, by Dr. W. M. Copenhaver, of the University of Rochester.

Emanation of rays from living cells, which speed up the division of other cells, as claimed by the Russian scientist, Dr. Gurwitch, was denied by two German plant physiologists at the University of Rostock, Professor H. von Guttenberg and Dr. Rossman, who repeated the Russian experiments with negative results.

Insects neither male nor female but containing characteristics of both sexes were produced in X-ray experiments by Professor James W. Mavor, of Union College, Schenectady, working in a London laboratory.

Successful crossbreeding of Alaska reindeer with native caribou and the production of fawns of materially increased weight was accomplished by the U. S. Biological Survey.

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The St. Francis dam, which impounds a large part of the water supply of Los Angeles, burst on March 12, causing a destructive flood.

Deposits of potash large enough to be of economic importance were discovered at two localities in Texas and one locality in New Mexico.

Astronomy

Plans to construct the world's largest telescope, with a concave mirror 200 inches in diameter, were announced by the California Institute of Technology, in cooperation with the Mount Wilson Observatory.

The Bureau of Standards constructed, by a new method, the disc for a huge telescope mirror of optical glass almost a foot thick, nearly six feet in diameter and almost two tons in weight, to be used in the first all-American-made telescope for Ohio Wesleyan University.

The year's first comet was discovered on Washington's birthday by a German astronomer, Dr. K. Reinmuth, of Heidelberg.

The year's second comet was discovered on St. Patrick's day by a Frenchman, M. Giacobini, of the Paris Observatory.

The third comet of the year was discovered by David L. Forbes, an astronomer at Capetown, Africa, on November 21, when it was observed in the constellation of Corvus, the crow.

The nucleus of our galaxy of stars was located by Dr. Harlow Shapley, of the Harvard College Observatory, who announced that it is about 47,000 light years away from the earth and extends for about fifty degrees along the Milky Way in the constellations of Sobieski's Shield, Ophiuchus, Sagittarius, Scorpion, the Southern Crown, the Altar, the Rule and the Centaur.

The presence of free oxygen in the atmosphere of Mars is best evidence for the existence of life there, Professor H. N. Russell, of Princeton, declared.

Nova pictoris, the "new" star which flashed out in May, 1925, continued to behave in a very different manner from usual novae, leading astronomers to the view that it might be due to an actual collision of two stars.

The Carnegie Institution of Washington has published the "San Luis Catalogue of 15,333 Stars," marking the completion of the first division in its general catalogue of all stars out to the seventh magnitude.

Evidence was brought forward at the Royal Observatory of Rome that our sun is a pulsating or variable star.

By using plates sensitive to infra-red light, a German astronomer, Dr. G. Blunck, succeeded in photographing the sun's corona, a feat hitherto possible only during a total eclipse.

The earth's rate of rotation changes slightly every day, Dr. Benjamin Boss, of the Dudley Observatory, Albany, New York, announced.

Further confirmation of the Einstein theory was announced, as the result of measurements made on photographs taken during the total solar eclipse of 1926.

The presence of a hitherto undiscovered planet, tentatively called "planet O," was announced by Professor W. H. Pickering, of Mandeville, Jamaica, from a study of its supposed perturbations on known planets, but observations with the biggest telescopes failed to confirm it.

Strange bands in the spectra of the light of certain stars may indicate that they are surrounded by meteors and comets, like the solar system, which may serve as fuel to keep the stars going, Dr. Harlow Shapley, of the Harvard College Observatory, declared.

Max Adler, Chicago philanthropist, gave that city a planetarium which will show the stars as seen from any part of the world at any time and the first to be given any city in the United States, though it will not be completed for a year or more.

On photographs made at the Lowell Observatory, Flagstaff, Arizona, of the spectrum of the Northern Lights on July 7 a very prominent line in the red region of the spectrum appeared for the first time, thus opening up a new scientific mystery, reported Dr. V. M. Slipher, director of the observatory, who recorded the phenomenon.

Moving pictures of the planet Jupiter, the first pictures of the kind ever made, were produced by Professor W. H. Wright, of the Lick Observatory, and Dr. C. E. K. Mees, of the research laboratory of the Eastman Kodak Company.

A prize of 5,000 francs was offered in France for the best paper on a means for reaching another planet; the new projected mode of travel is called "astronautics."

Engineering

A method of utilizing for power the difference in temperature between the depths and surface of tropical seas was devised and successfully demonstrated by Georges Claude, the French physicist and inventor.

Busses carrying 26 passengers, with sleeping accommodations, dining and toilet facilities, were placed in operation.

A new stereoscopic apparatus for making contour maps from overlapping photographs was purchased by the government and is expected to revolutionize topographic mapping in mountainous countries.

The Army Air Corps photographed areas in the United States approximating 35,000 square miles for the War Department and other governmental bureaus.

Radio acoustic sound ranging, making possible the locating of ships even in darkness and fog, was developed.

An apparatus called the fathometer for measuring ocean depths by means of echo sounding was perfected and placed in use on 8 boats of the Coast and Geodetic Survey.

A new world's speed record for automobiles was made at Daytona Beach, Fla., by Captain Malcolm Campbell, an Englishman, who was later killed when his car overturned.

Diesel type engines light enough for automobile and airplane use approached the point of commercial practicability.

A new super-fast motion-picture camera, through which film travels at the rate of three miles a minute, was perfected by C. Francis Jenkins, Washington inventor.

Two condemned buildings in Washington were burned to the ground by scientists of the Bureau of Standards in order to test fire-proof safes under actual conflagration conditions.

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January, 1929

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